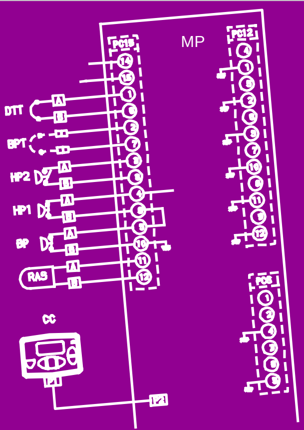
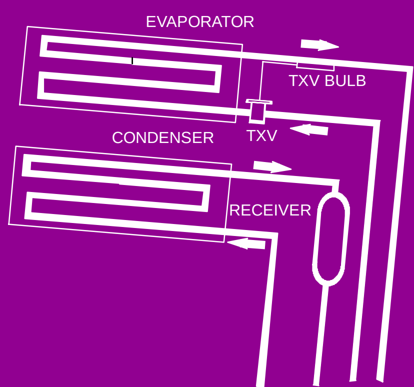
Truck Refrigeration







OPERATION & SERVICE
for
40 And 50X
Direct Drive
Truck Refrigeration Units

62–11044 Rev A Change 09/11

OPERATION AND SERVICE MANUAL

40X And 50X

DIRECT DRIVE

TRUCK REFRIGERATION UNITS

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SAFETY SUMMARY

GENERAL SAFETY NOTICES

The following general safety notices supplement the specific warnings and cautions appearing elsewhere in this manual. They are recommended precautions that must be understood and applied during operation and maintenance of the equipment covered herein. The general safety notices are presented in the following three sections labeled: First Aid, Operating Precautions and Maintenance Precautions. A listing of the specific warnings and cautions appearing elsewhere in the manual follows the general safety notices.

Your Carrier Transicold refrigeration unit has been designed with the safety of the operator in mind. During normal operation, all moving parts are fully enclosed to help prevent injury. During all pre-trip inspections, daily inspections, and problem troubleshooting, you may be exposed to moving parts. Stay clear of all moving parts when the unit is in operation and when the ON/OFF switch is in the ON position.

FIRST AID

An injury, no matter how slight, should never go unattended. Always obtain first aid or medical attention immediately.

OPERATING PRECAUTIONS

Always wear safety glasses. Wear hearing protection as required.

Keep hands, clothing and tools clear of the evaporator and condenser fans.

No work should be performed on the unit until all circuit breakers and the Emergency Switch are turned off, and battery power supply is disconnected.

Always work in pairs. Never work on the equipment alone.

In case of severe vibration or unusual noise, stop the unit and investigate.

MAINTENANCE PRECAUTIONS

Beware of unannounced starting of the unit. This unit is equipped with Auto-Start in both the road and standby modes. The unit may start at any time. When performing any check of the system make certain the Emergency Switch is in the OFF position.

Be sure power is turned off before working on motors, controllers, solenoid valves and electrical control switches. Tag circuit breaker and vehicle ignition to prevent accidental energizing of circuit.

Do not bypass any electrical safety devices, e.g. bridging an overload, or using any sort of jumper wires. Problems with the system should be diagnosed, and any necessary repairs performed, by qualified service personnel.

When performing any arc welding on the unit or container, disconnect all wire harness connectors from the microprocessor. Do not remove wire harness from the modules unless you are grounded to the unit frame with a static safe wrist strap.

In case of electrical fire, open circuit switch and extinguish with CO_2 (never use water).

REFRIGERANTS

The refrigerant contained in your unit can cause frostbite, severe burns, or blindness when in direct contact with the skin or eyes. For this reason, and because of legislation regarding the handling of refrigerants during system service, we recommend that you contact your nearest Carrier Transicold authorized repair facility whenever your unit requires refrigeration system service .

SPECIFIC WARNING AND CAUTION STATEMENTS

To help identify the label hazards on the unit and explain the level of awareness each one carries, an explanation is given with the appropriate consequences:

DANGER – means an immediate hazard which WILL result in severe personal injury or death.

WARNING – means to warn against hazards or unsafe conditions which COULD result in severe personal injury or death.

CAUTION – means to warn against potential hazard or unsafe practice which could result in minor personal injury, product or property damage.

The statements listed below are applicable to the refrigeration unit and appear elsewhere in this manual. These recommended precautions must be understood and applied during operation and maintenance of the equipment covered herein.

WARNING

Beware of unannounced starting of the unit. The unit may cycle the fans and operating compressor unexpectedly as control requirements dictate. To ensure unit will not start, place the EMERGENCY SWITCH (see Figure 1-1) in the OFF position. To ensure unit is without power, remove power plug and remove battery negative cable.

WARNING

Do not attempt to connect or remove power plug before ensuring the unit is OFF (press OFF key on Cab Command) and external power circuit breaker is open.

WARNING

Make sure the power plug is clean and dry before connecting to any power source

WARNING

Beware of V-belt and belt-driven components as the unit may start automatically.

WARNING

Do not use a nitrogen cylinder without a pressure regulator. (See Figure 4-6) Cylinder pressure is approximately 2350 psi (160 bar). Do not use oxygen in or near a refrigerant system as an explosion may occur.

CAUTION

Under no circumstances should anyone attempt to repair the microprocessor module or Cab Command! Should a problem develop with these components, contact your nearest Carrier Transicold dealer for replacement.

CAUTION

If starting unit for the first time after installation the compressor pressure regulating valve will need to be reset (refer to paragraph 4.11)

CAUTION

If starting unit for the first time after installation or starting after adding/removing an optional feature or if Owners operating parameters have changed the Configuration will need to be reset (refer to paragraph 2.5)

CAUTION

To prevent trapping liquid refrigerant in the manifold gauge set be sure set is brought to suction pressure before disconnecting.

CAUTION

When working with refrigerant use safety glasses and gloves to avoid burns. Hoses and copper tubing can be hot when unit is running.

CAUTION

Refrigerant R404a is a blend. Charging as a vapor will change the properties of the refrigerant. Only liquid charging through the king valve is acceptable.

CAUTION

Do not damage or over tighten the enclosing tube assembly. Also make sure all parts are placed in the enclosing tube in proper sequence to avoid premature coil burn-out.

SECTION 1

DESCRIPTION

1.1 INTRODUCTION

⚠ WARNING

Beware of unannounced starting of the unit. The unit may cycle the fans and operating compressor unexpectedly as control requirements dictate. To ensure unit will not start, place the EMERGENCY SWITCH (see Figure 1-1) in the OFF position. To ensure unit is without power, remove power plug <u>and</u> remove battery negative cable.

This manual contains Operating Data, Electrical Data and Service Instructions for the Carrier Transicold Model 40X and 50X truck refrigeration units listed in Table 1-1.

The unit (Figure 1-1) is of the split system type with the condenser mounted outside the truck body, evaporator mounted in the body, and a CAB COMMAND control center mounted in the drivers compartment. Two types of compressor drive are available:

The control system is a microprocessor controller. Once the controller is set at the desired temperature, the system automatically selects cooling and heating cycles as necessary to maintain the desired temperature within very close limits.

- **Road operation**

  the compressor is driven by the engine of the vehicle when in operation over-the-road.

- **Road/Standby operation**

  With the standby option a second compressor is mounted in the condenser section. This compressor is driven by 230 volt, single or three phase power.

The model/serial nameplate is located inside the unit on the frame as shown in Figure 1-1.

1.2 CONDENSING SECTION

The condenser section (see Figure 1-2 & Figure 1-3) contains the condenser fan & coil, filter-drier, oil separator, receiver, condenser pressure control valve, condenser pressure control switch, hot gas valve, high pressure switch and microprocessor. On road/standby units the condenser also houses the standby compressor, control box and rectifier/transformer assembly. In addition, single phase units are fitted with a start box which contains the capacitors and relay.

1.2.1 Condenser Coil

The condenser is of the tube and fin type and acts as a heat exchanger in which the compressed refrigerant gas is condensed into a liquid and lowered in temperature. Air movement over the condenser is provided by a fan mounted in the condensing section.

1.2.2 Filter Drier

The drier is a cylindrical shell containing a drying agent and screen. It is installed in the liquid line and functions to keep the system clean and remove moisture from the refrigerant.

1.2.3 Hot Gas Solenoid Valve (HGS1)

HGS1 is normally closed and prevents discharge gas from entering the evaporator. The valve opens to allow hot gas refrigerant to be delivered from the compressor to the evaporator during heat or defrost modes.

Table 1-1 Model Chart

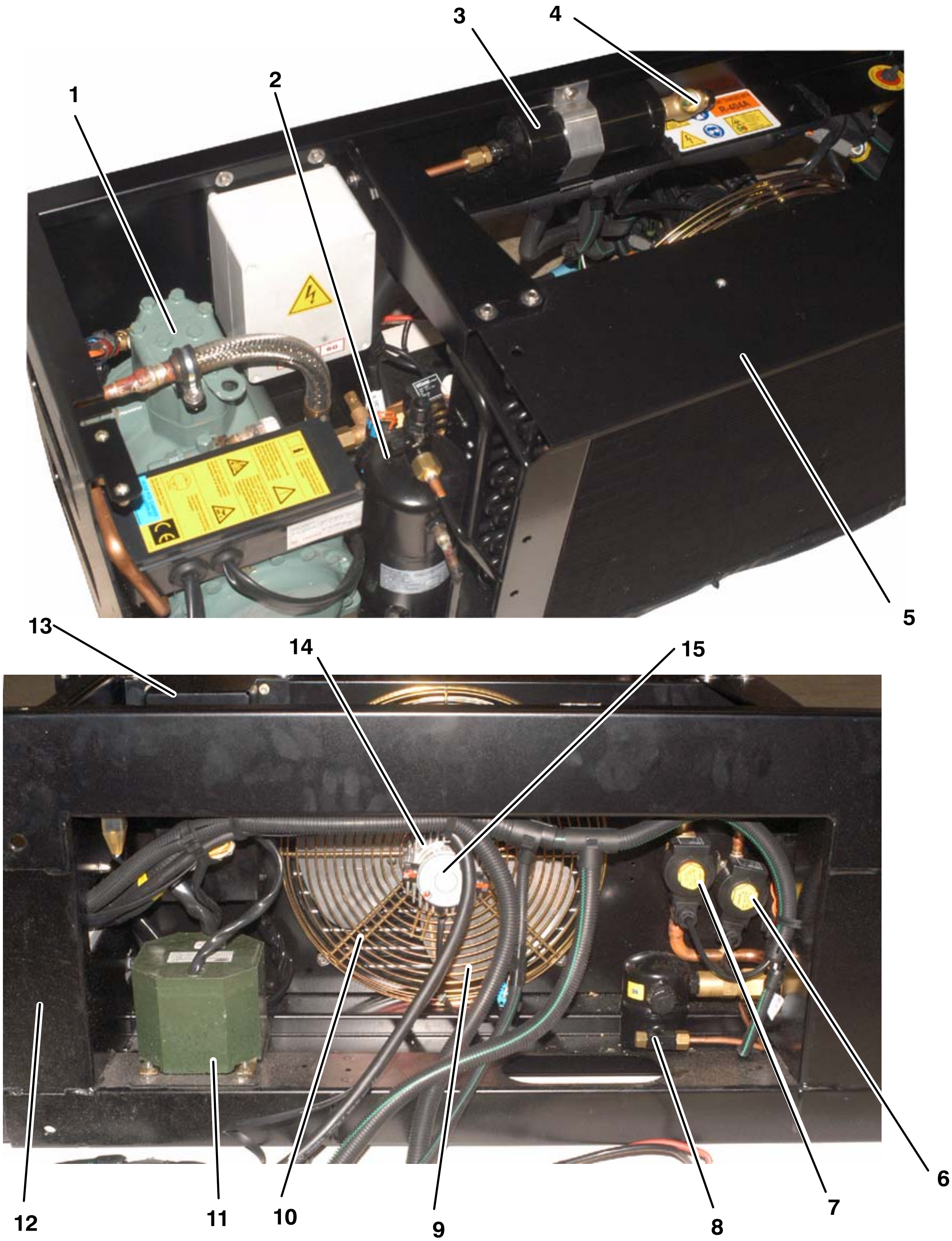
Model	R-404a		Road Compressor	Standby Compressor	Condenser Weight		Evaporator Weight
	LB	KG			Road	Road and Standby	
40X	6.6	3.0	TM 16	06VM306 (3 & 1 phase)	192 lb (87 kg)	320 lb (145 kg)	64 lb (29kg)
50X	7.1	3.3	TM 16	06VM307 (3 phase) 06VM306 (1 phase)			86 lb (39 kg)

Table 1-2. Additional Support Manuals

Manual Number	Equipment Covered	Type of Manual
62-11043	40X/50X	Parts List
62-11045	Direct Drive Truck Units With Cab Command Two	Operator's Manual
62-11046	Direct Drive Truck Units With Cab Command Two	Easy To Run Manual

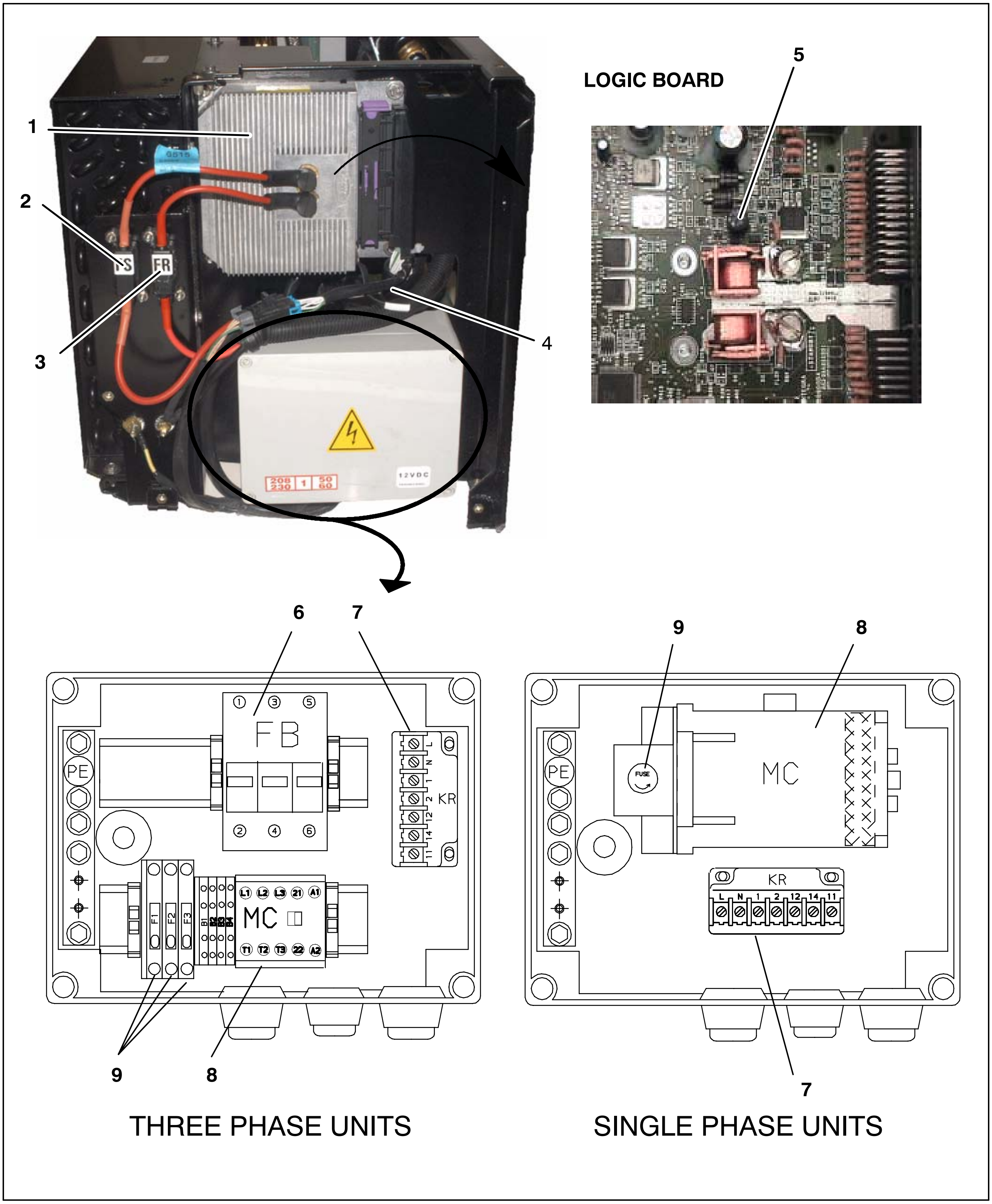


Figure 1-1 MAIN UNIT COMPONENTS



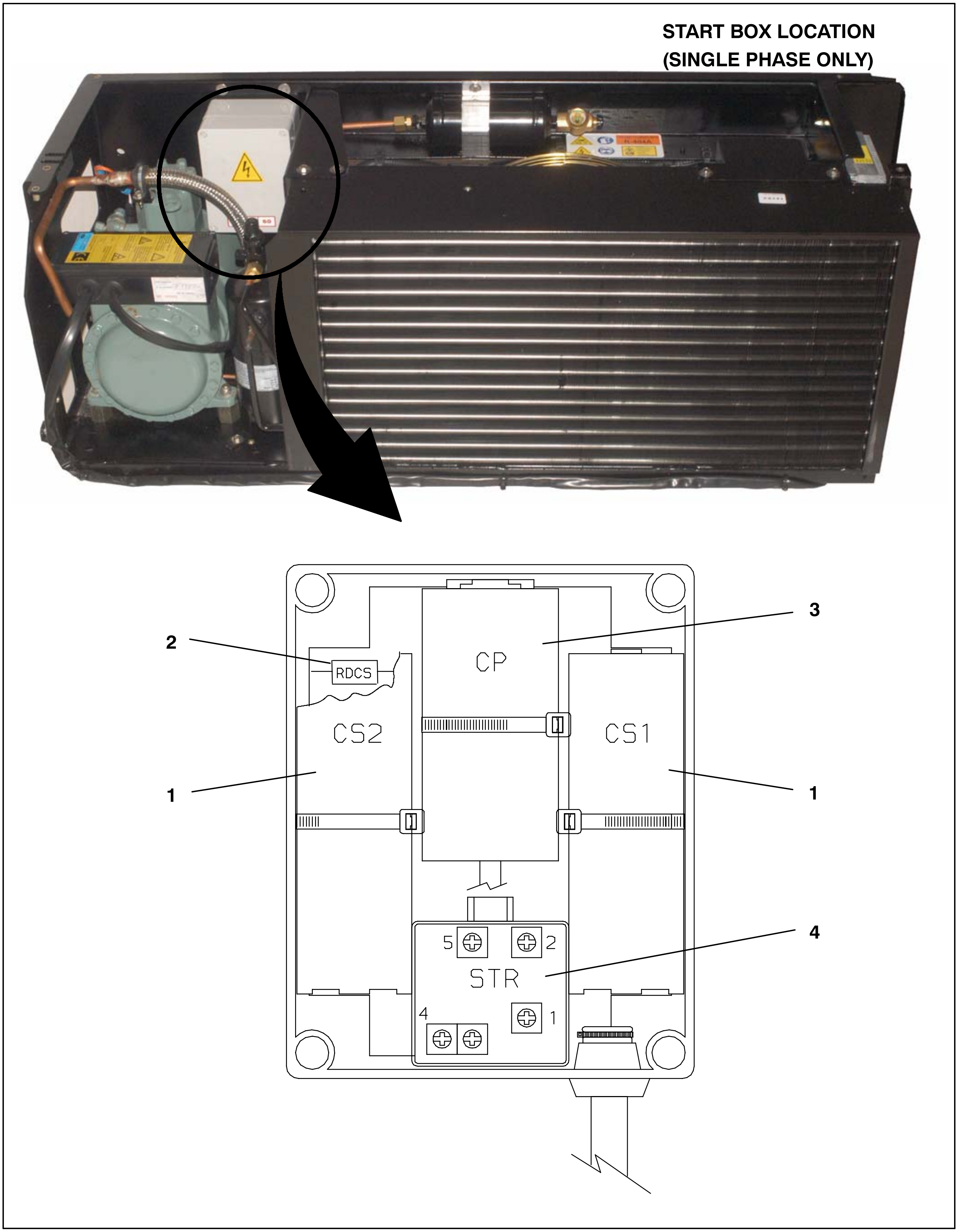
1. Standby Compressor
2. Receiver
3. Filter-Drier
4. Sight Glass
5. Condenser Coil
6. Hot Gas Valve (HGS1) And Coil
7. Condenser Pressure Control Valve (HGS2) And Coil
8. Oil Separator
9. Condenser Fan
10. Fan Guard
11. Transformer (TR)
12. Frame Assembly
13. Rectifier Bridge Assembly (RB)
14. Heat Sink
15. Condenser Fan Motor (CFM)

Figure 1-2 Condenser



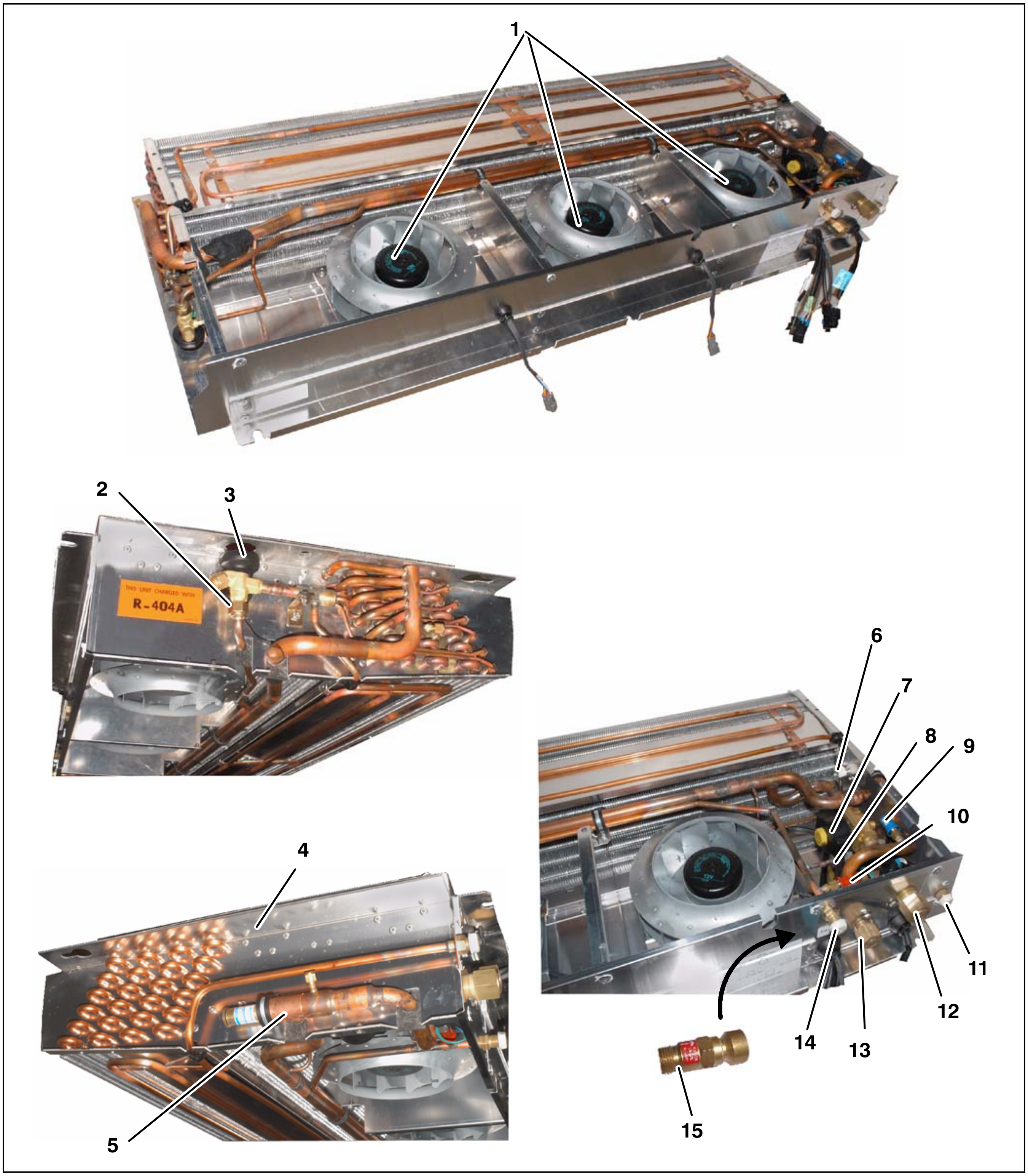
1. Microprocessor
2. Standby Fuse (FS)
3. Road Fuse (FR)
4. Harness
5 1A Field Replaceable Fuse (12-00526-88) (Starting with Controller S/N 1997)
6. Fused Disconnect (FB) - Three Phase Only
7. Electronic Overload Relay (KR)
8. Standby Contactor (MC)
9. Primary Transformer Fuses (F1,2,3 Three Phase Units - F1 Single Phase Units)

Figure 1-3 Control Box



1. Start Capacitor
2. Resistor, Start Capacitor Discharge
3. Run Capacitor
4. Start Relay

Figure 1-4 Start Box (Single Phase Only)



1. Evaporator Fan Motor & Blowers (EFM)
2. Orifice
3. Thermostatic Expansion Valve
4. Evaporator Coil Assembly
5. Compressor Pressure Regulating Valve (CPR)
6. Defrost Termination Thermostat (DTT)
7. Suction Bypass Valve (SBPV) (50X Only)
8. Quench Valve (BPV)
9. Low Pressure Switch (LP)
10. High Ambient Pressure Switch (HP4) (50X Only)
11. Hot Gas Fitting
12. Road Suction Line Fitting
13. Standby Suction Line Fitting
14. Liquid Line Fitting
15. Liquid Line Check Valve

Figure 1-5 Evaporator (50X Shown)

1.2.4 Condenser Pressure Control Valve (HGS2)

The condenser pressure control valve (or condenser closing valve) is a normally open valve that is powered when the condenser pressure control switch (HP2) is closed. With the solenoid coil de-energized, the valve is in the cool mode and the compressor discharge gas is delivered to the condenser. In the cool mode, heat is removed from the air inside the truck body and rejected to the surrounding air. With the solenoid coil energized, the valve is in the heat mode and the compressor discharge gas is diverted to the evaporator and rejected to the air inside the truck body.

1.2.5 Compressor

The compressor withdraws refrigerant gas from the evaporator and delivers it to the condenser at an increased pressure. The pressure is such that refrigerant heat can be absorbed by the surrounding air at ordinary temperatures.

1.2.6 Receiver

Liquid refrigerant from the condenser is delivered to the receiver. The receiver serves as a liquid reservoir when there are surges due to load changes in the system; as a storage space when pumping down the system and as a liquid seal against the entrance of refrigerant gas into the liquid line.

1.2.7 High Pressure Switch (HP1)

HP1 is a normally closed switch which monitors the system for high pressure and shuts down the unit when pressure rises above predetermined setting. For HP1 settings see Section 1.5.2.

1.2.8 Condenser Pressure Control Switch (HP2)

HP2 is a normally open switch which closes to signal the microprocessor to activate the condenser fan. HP2 also cycles the condenser pressure control valve (HGS2) and the quench valve (BPV) in addition to the condenser fan in order to maintain discharge pressure for heating capacity. For HP2 settings see Section 1.5.2.

1.2.9 Standby High Pressure Switch (HP3)

HP3 is a normally closed switch mounted on the standby compressor which monitors the system for high pressure when in standby mode. It signals the microprocessor to shut down the unit when pressure rises above predetermined setting. For HP3 settings see Section 1.5.2.

1.2.10 Standby Motor

The standby motor operates on nominal 208/230v-1ph-60hz or 230v-3ph-60hz power. An overload and short cycle protection is provided along with automatic reset. Units are also equipped with a remote mounted power receptacle.

1.3 EVAPORATOR SECTION

The evaporator assembly (see Figure 1-1 and Figure 1-5) consists of the evaporator blowers (3 each for the 50X, 2 each for the 40X), the evaporator coil, thermostatic expansion valve, defrost termination thermostat, compressor pressure regulating valve, low pressure switch and quench valve. In addition, the 50X unit is fitted with a suction bypass valve and a high ambient pressure switch.

1.3.1 Thermostatic Expansion Valve

The thermostatic expansion valve is an automatic device which controls the flow of liquid to the evaporator according to changes in superheat of the refrigerant leaving the evaporator. The thermal expansion valve maintains a relatively constant degree of superheat in the gas leaving the evaporator regardless of suction pressure. Thus, the valve has a dual function; automatic expansion control and preventing liquid from returning to the compressor. For TXV superheat settings see Section 1.5.2. To adjust the TXV, refer to Section 4.12.2.

1.3.2 Bypass System

a. Compressor Pressure Regulating Valve (CPR)

The CPR valve is installed on the suction line to regulate the suction pressure entering the compressor. The CPR valve is set to limit the maximum suction pressure. For CPR settings refer to section 1.5.2.

b. Suction Bypass (50X Only)

During periods of high ambient operation, the high ambient pressure switch (HP4) opens to close the suction bypass valve (SBPV) and bring the compressor pressure regulating valve (CPR) into operation. On pressure fall, the switch closes to energize the suction bypass valve (SBPV), bypassing the compressor regulating valve. For HP4 settings refer to section 1.5.2.

1.3.3 Defrost Termination Thermostat (DTT)

Normally closed thermal switch which monitors setpoint. As evaporator cools to setpoint, the switch closes and signals microprocessor that defrost may be initiated. Switch terminates defrost by opening at predetermined setpoint. For DTT settings refer to section 1.5.2.

1.3.4 Quench Valve (BPV)

The quench valve is a normally closed solenoid valve controlled by the quench thermostat (BPT) mounted on the road compressor discharge line. The valve allows metered liquid refrigerant to enter the suction line in the evaporator in order to provide compressor cooling. For BPT settings refer to section 1.5.2.

1.3.5 Evaporator Coil

The evaporator is of the tube and fin type. The operation of the compressor maintains a reduced pressure within the coil. At this reduced pressure, the liquid refrigerant evaporates at a temperature sufficiently low enough to absorb heat from the air. Air movement over the evaporator is provided by an electric fan.

1.3.6 Low Pressure Switch (LP)

The low pressure switch is a normally closed switch which signals the microprocessor to shut down the unit when the system is outside the low pressure limit. For LP settings refer to section 1.5.2.

1.4 SYSTEM OPERATING CONTROLS AND COMPONENTS

The unit is furnished with a microprocessor control system. Once the setpoint is entered at the Cab Command, the unit will operate automatically to maintain the desired temperature within very close limits. See 2.1.1.

WARNING

Beware of unannounced starting of the evaporator or condenser fans. The unit may cycle fans unexpectedly as control requirements dictate.

CAUTION

Under no circumstances should anyone attempt to repair the microprocessor module or Cab Command! Should a problem develop with these components, contact your nearest Carrier Transicold dealer for replacement.



Figure 1-6 Cab Command Two

1.5 UNIT SPECIFICATIONS

1.5.1 COMPRESSOR REFERENCE DATA

Model	TM 16	06VM306Y TC6	06V30660Y
		230/1/60	230/3/60
Displacement	163 cc	6.9 cfm (11.8m3/h)	6.9 cfm (11.8m3/h)
No. Cylinders	6	2	
Weight	7 kg	(88.2 lbs) 40 kg	(88.2 lbs) 40 kg
Oil Charge	250 cc (0.53 pt.)	1200 cc (2.5 pts.)	
Approved oil	POE – Mobil Arctic EAL 68 (Carrier Part Number 46-60002-02)		

1.5.2 REFRIGERATION SYSTEM DATA

c. Defrost Timer

Automatic triggering or at preset intervals :
0, auto, 1h, 2h, 3h, 4h, 5h, 6h

d. Defrost Termination Thermostat

Opens on a temperature rise at: 50_ ¦ 5_F (10_ ¦ 3_C)

Closes on a temperature fall at: 40_ ¦ 5_F (4.4_ ¦ 3_C)

e. High Pressure Switch (HP1)

Opens on a pressure rise at: 465 ¦ 10 psig (32 bar)

Closes on a pressure fall at: 360 ¦ 10 psig (25 bar)

f. Condenser Pressure Switch (HP2)

Opens on a pressure fall at : 245 ¦ 10 psig1 (17 bar)

Closes on a pressure rise at: 320 ¦ 10 psig (22 bar)

g. Standby High Pressure Switch (HP3)

Opens on a pressure rise at: 435 ¦ 10 psig (30 bar)

Closes on a pressure fall at: 360 ¦ 10 psig (25 bar)

h. High Ambient Pressure Switch (HP4) – 50X Only

Opens on a pressure rise at: 398 ¦ 10 psig (27.5 bar)

Closes on a pressure fall at: 334 ¦ 10 psig (23 bar)

i. Refrigerant charge

Refer to Table 1-1.

j. Compressor Pressure Regulating Valve (CPR)

40X: Setting; 36 ¦ 1 psig (2.3 bar) Adjust on road operation only.

50X: Setting; 38 ¦ 1 psig (2.6 bar)

k. Thermostatic Expansion Valve

TES 2/ Orifice n_4/ MOP 75 psig (5.1 bar):
Super heat: 13_ to 15_F (8_C) at 32_F (0_C)
11_ to 12_F (7_C) at 0_F (–20_C)

l. Low Pressure Switch (LP)

Opens on a pressure fall at: 6.0 inHg ¦ 6 (-0.2 bar)

Closes on a pressure rise at: 14.5 psig ¦ 3 psig (1 bar)

m. Quench Valve Thermostat (BPT)

Opens on a temperature fall at: 220_ ¦ 7_F (105_ ¦ 4_C)

Closes on a temperature rise at: 248_ ¦ 7_F (120_ ¦ 4_C)

1.5.3 ELECTRICAL DATA

a. Fan Motors

Evaporator Fan Motor (EFM)		Condenser Fan Motor (CFM)	
Bearing Lubrication	Factory Lubricated	Bearing Lubrication	Factory Lubricated
Horse Power	100w		70w
Operating Amps	8.4 amps	Operating Amps	7.5 amps
Speed	2100 rpm (rated)	Speed	2350/2600 rpm

b. Standby Compressor Speed
1740 rpm – 60 hz

c. Compressor Motor Ratings

UNIT	Voltage	Frequency	Phase	kW	HP	Contactor Data	
						MRA*	LRA*
40/50X	208 / 230	60 Hz	1	1.491	2	15.6	78.7
40/50X	208 / 230	60 Hz	3	1.491	2	11.8	45.1

* MRA = Maximum Rotor Amps LRA = Locked Rotor Amps

d. Road Compressor Clutch (CLHR) Coil

Amp Draw = 3.75A
Resistance = 3.2Ω

e. Hot Gas Solenoid Valve (HGS1 and HGS2) Coils

Amp Draw = 1650 mAmp
Resistance = 7.2Ω

f. Suction Bypass Valve (SBPV) Coil

Amp Draw = 1650 mAmp
Resistance = 7.2Ω

g. Quench Valve (BPV) Coil

Amp Draw = 1160 mAmp
Resistance = 10.3Ω

1.6 TORQUE VALUES

Assembly	Ft–Lbs	N.m	Size
Standby compressor	4.1	5.5	M 10
Evaporator Fan Motor – Bracket	2.2	3	M 4
Condenser – frame	7.4	10	M 6
Condenser Fan – Blade	3.7	5	M 6
Mounting bolts	84.1	114	M 12

1.7 SAFETY DEVICES

System components are protected from damage caused by unsafe operating conditions by automatically shutting down the unit when such conditions occur. This is accomplished by the fuses and safety devices listed in the following table.

Table 1-3 Safety Devices

	Unsafe Conditions	Safety Device	Automatic restart with fault cleared	Device setting
1	Excessive drop in pressure	Automatic reset of low pressure switch	YES	Cutout : −2.9 psig (-0.2 bar) Timer 5 mn
2	Excessive current draw on all microprocessor outputs (evaporator and condenser fan)	Electronic relay	YES	Self-protected opening
3	Excessive current draw motor compressor	Overload relay	YES	See electrical wiring diagram
4	Excessive compressor discharge pressure	Automatic reset of High pressure switch (HP1, HP3)	YES	Timer 5 mn
5	Excessive current draw unit on standby	Standby fuse (FS) [a]	NO	50A
6	Excessive current draw unit on road	Road fuse (FR)	NO	50A
7	Excessive current draw unit on road	Main Road fuse (FR1) [b]	NO	60A
8	Excessive current draw control circuit	Fuse on electronic board (Field Replaceable) [c]	NO	1A (Time Delayed)
9	Connection error on primary transformer	F1 230/1/60	NO	5A (Time Delayed)
		F1, F2, F3 230/3/60		3.15A (Time Delayed)
10	Excessive compressor motor winding temperature	PTO (overload protector)	YES	Self-protected opening
11	Clutch malfunction - road (excessive current draw)	Electronic relay	YES	Self-protected opening
12	Clutch malfunction - road (insufficient current draw)	Electronic relay	YES	Detection of min. threshold at 750 mA
13	Double power supply (road + standby)	Microprocessor	YES	Display on Cab Command until one of the 2 power supplies have been disconnected.
14	Low battery voltage	Microprocessor	YES	Cutout/cut-in at 10 V
15	Suction bypass coil shorted	Suction Bypass Fuse (FSBP) [d]	YES	3A
16	Excess current draw of AC circuits	Main Standby Fuse Block (FB) [e]	YES	16A

(a) On road / standby unit only

(b) This fuse is located close to the vehicle battery (12 v).

(c) This fuse is located on the logic board inside the microprocessor and protects the microprocessor against reverse polarity on the power supply. (See Figure 1-3).

(d) 50X units only

(e) 230/3/60 units only

1.8 REFRIGERANT CIRCUIT

1.8.1 REFRIGERANT CIRCUIT DURING COOLING

When cooling (See Figure 1-7), the unit operates as a vapor compression refrigeration system. The main components of the system are the reciprocating compressor, air-cooled condenser, thermostatic expansion valve, direct expansion evaporator and the hot gas solenoid.

The compressor raises the pressure and temperature of the refrigerant and forces it through the discharge check valve and condenser pressure control valve into the condenser tubes. The discharge check valves prevent reverse flow through the non operating compressor.

When operating on the road compressor, the flow also passes through an oil separator where oil is removed and returned to the compressor.

The condenser fan circulates surrounding air over the outside of the condenser tubes. Heat transfer is thus established from the refrigerant gas (inside the tubes) to the condenser air (flowing over the tubes). The condenser tubes have fins designed to improve the transfer of heat. This removal of heat causes the refrigerant to liquefy. Liquid refrigerant flows from the condenser to the receiver.

The receiver stores the additional charge necessary for low ambient operation and for heating and defrost modes.

The refrigerant leaves the receiver and flows through a manual receiver shut-off valve (king valve).

The refrigerant then flows through the filter-drier, where an absorbent keeps it dry and clean and then through a sight glass. The sight glass is fitted with an indicator that changes color to indicate moisture content of the refrigerant.

The refrigerant then flows through the subcooler which removes additional heat from the liquid to improve system efficiency and then through the liquid line check valve. The check valve serves to prevent reverse flow of refrigerant during the heating/defrost cycle.

The liquid than enters the thermostatic expansion valve (with external pressure equalizer) which regulates the flow rate of refrigerant towards the evaporator in order to obtain maximum use of the evaporator heat transfer surface.

The evaporator tubes have aluminium fins to increase heat transfer; therefore heat is removed from the air circulated through the evaporator. This cold air is circulated throughout the truck to maintain the cargo at the desired temperature.

The transfer of heat from the air to the low temperature liquid refrigerant causes the liquid to vaporize. The vapor at low temperature enters the compressor pressure regulating valve (CPR) which regulates refrigerant pressure entering the compressor to prevent overloading of the compressor. The refrigerant passes through the suction bypass valve (SBPV) and from this point the cycle starts over.

During periods of high ambient operation, when liquid line pressure rises above the setting of the high ambient switch (HP4), the switch opens to de-energize (close) the suction bypass valve and bring the CPR into the circuit.

The quench valve (BPV) opens as required to maintain a maximum discharge temperature of 127°C (260°F).

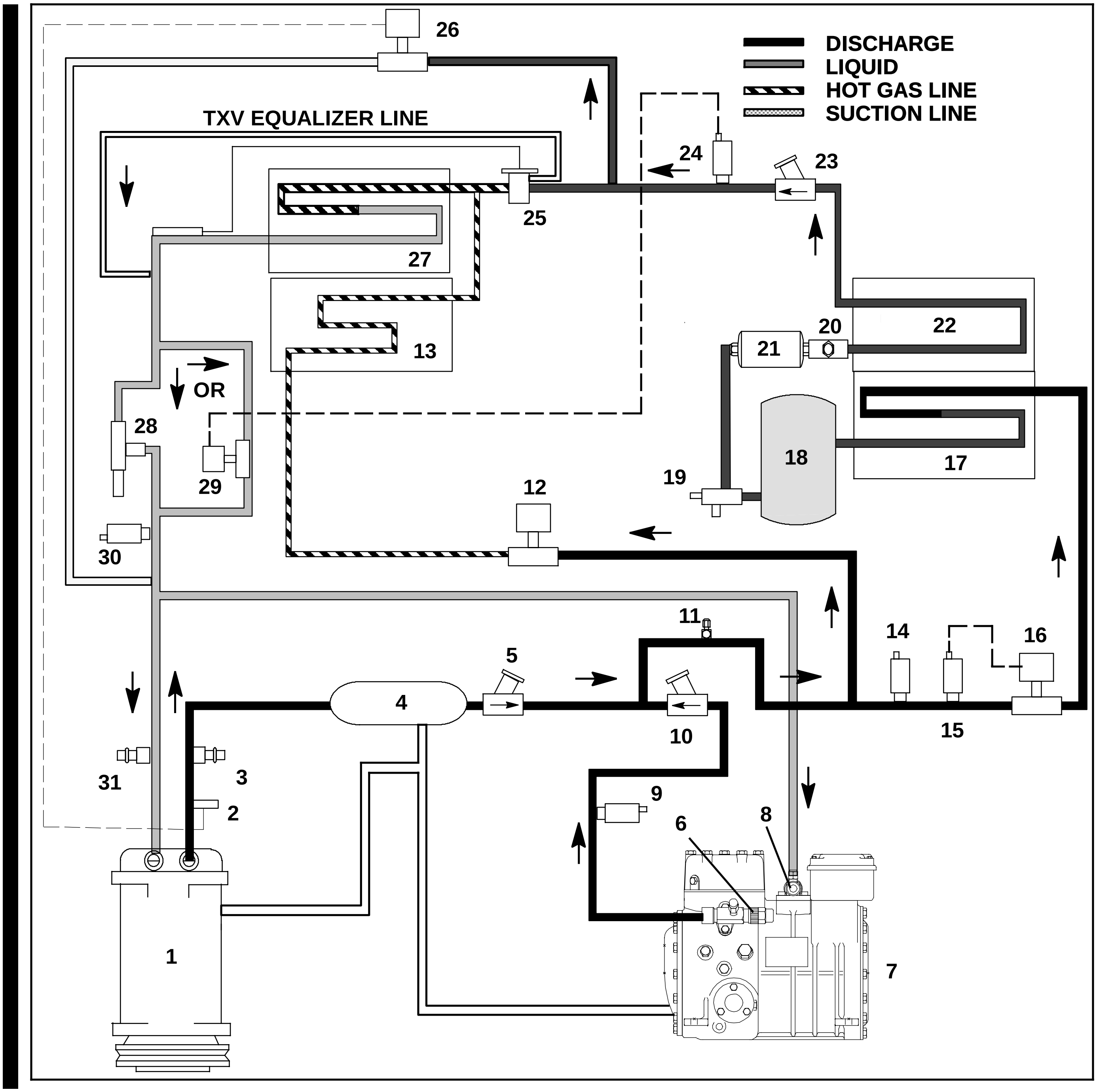
1.8.2 REFRIGERANT CIRCUIT DURING HEAT AND DEFROST

When refrigerant vapor is compressed to a high pressure and temperature in a compressor, the mechanical energy necessary to operate the compressor is transferred to the gas as it is being compressed. This energy is referred to as the ”heat of compression ” and is used as the source of heat during the heating or defrost cycle (See Figure 1-8 and Figure 1-9).

When the microprocessor activates heating or defrost, the hot gas solenoid valve (HGS1) energizes and the condenser pressure control valve (HGS2) energizes, closing the port to the condenser which allows heated refrigerant vapor to flow directly to the evaporator coil .

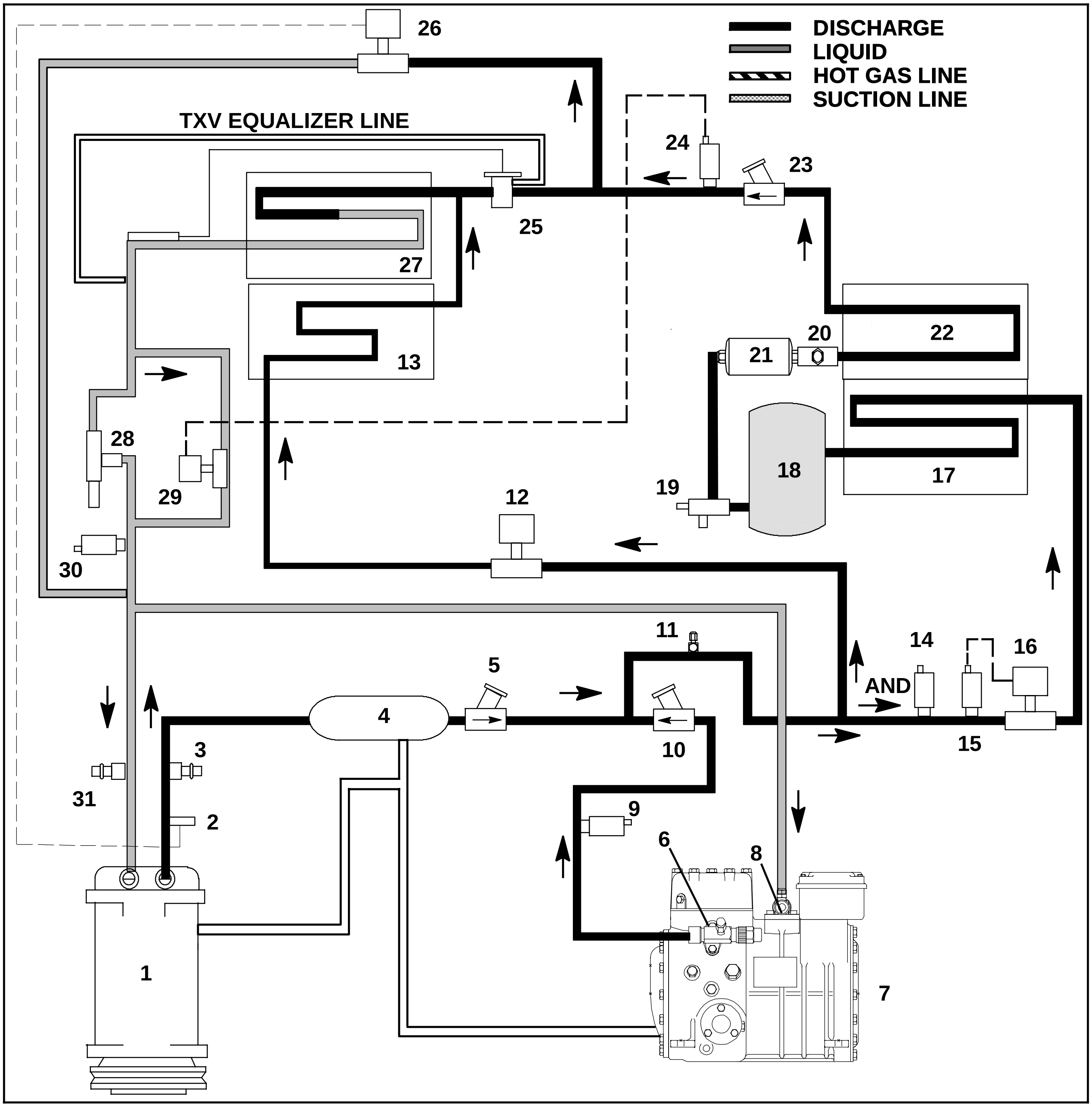
The main difference between heating and defrosting is that, when in heating mode the evaporator fans continue to run circulating the air throughout the truck to heat the product. When defrosting, the evaporator fans stop, allowing the heated vapor to defrost any ice build-up on the coil.

HGS2 closes when pressure is below the setting of the condenser pressure control switch (HP2)to prevent additional pressure rise in the system. When pressure is below the setting of the condenser pressure control switch, the HGS2 is closed to the condenser. Additionally the BPV is opened to allow additional refrigerant into the system and increase heating capacity.



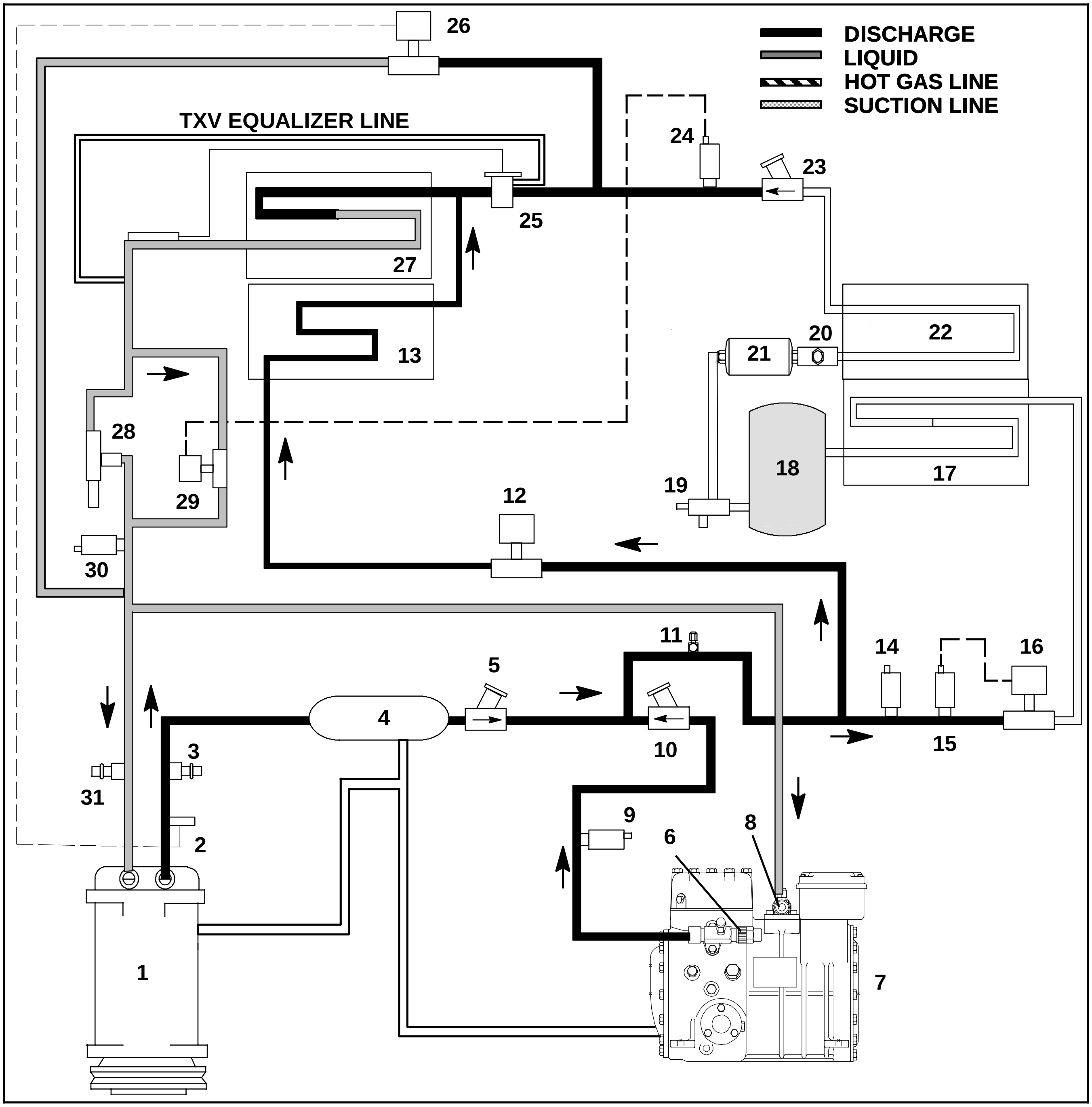
1 Road Compressor
2 Quench Thermostat (BPT)
3 Discharge Charging Port
4 Oil Separator
5 Road Discharge Check Valve
6 Standby Discharge Service Valve
7 Standby Compressor
8 Standby Suction Service Valve
9 Standby High Pressure Switch (HP3)
10 Standby Discharge Check Valve
11 Relief Valve
12 Hot Gas Solenoid Valve (HGS1)
13 Drain Pan Hot Gas Line
14 High Pressure Switch (HP1)
15 Condenser Pressure Control Switch (HP2)
16 Condenser Pressure Control Valve (HGS2)
17 Condenser Coil
18 Receiver
19 Manual Shut-off Valve (King Valve)
20 Sight Glass
21 Filter–Drier
22 Subcooler
23 Liquid Line Check Valve
24 High Ambient Pressure Switch (HP4) (50X Only)
25 Thermostatic Expansion Valve
26 Quench Valve (BPV)
27 Evaporator Coil
28 Compressor Pressure Regulating Valve (CPR)
29 Suction Bypass Valve (SBPV) (50X Only)
30 Low Pressure Switch (LP)
31 Suction Charging Port

Figure 1-7 Refrigeration Circuit Cooling Cycle



1 Road Compressor
2 Quench Thermostat (BPT)
3 Discharge Charging Port
4 Oil Separator
5 Road Discharge Check Valve
6 Standby Discharge Service Valve
7 Standby Compressor
8 Standby Suction Service Valve
9 Standby High Pressure Switch (HP3)
10 Standby Discharge Check Valve
11 Relief Valve
12 Hot Gas Solenoid Valve (HGS1)
13 Drain Pan Hot Gas Line
14 High Pressure Switch (HP1)
15 Condenser Pressure Control Switch (HP2)
16 Condenser Pressure Control Valve (HGS2)
17 Condenser Coil
18 Receiver
19 Manual Shut-off Valve (King Valve)
20 Sight Glass
21 Filter–Drier
22 Subcooler
23 Liquid Line Check Valve
24 High Ambient Pressure Switch (HP4) (50X Only)
25 Thermostatic Expansion Valve
26 Quench Valve (BPV)
27 Evaporator Coil
28 Compressor Pressure Regulating Valve (CPR)
29 Suction Bypass Valve (SBPV) (50X Only)
30 Low Pressure Switch (LP)
31 Suction Charging Port

Figure 1-8 Refrigeration Circuit Heating and Defrost Cycle – HGS2 Open



1 Road Compressor
2 Quench Thermostat (BPT)
3 Discharge Charging Port
4 Oil Separator
5 Road Discharge Check Valve
6 Standby Suction Service Valve
7 Standby Compressor
8 Standby Discharge Service Valve
9 Standby High Pressure Switch (HP3)
10 Standby Discharge Check Valve
11 Relief Valve
12 Hot Gas Solenoid Valve (HGS1)
13 Drain Pan Hot Gas Line
14 High Pressure Switch (HP1)
15 Condenser Pressure Control Switch (HP2)
16 Condenser Pressure Control Valve (HGS2)
17 Condenser Coil
18 Receiver
19 Manual Shut-off Valve (King Valve)
20 Sight Glass
21 Filter–Drier
22 Subcooler
23 Liquid Line Check Valve
24 High Ambient Pressure Switch (HP4) (50X Only)
25 Thermostatic Expansion Valve
26 Quench Valve (BPV)
27 Evaporator Coil
28 Compressor Pressure Regulating Valve (CPR)
29 Suction Bypass Valve (SBPV) (50X Only)
30 Low Pressure Switch (LP)
31 Suction Charging Port

Figure 1-9 Refrigeration Circuit Heating and Defrost Cycle – HGS2 Closed

SECTION 2

OPERATION

⚠ WARNING

Beware of unannounced starting of the unit. The unit may cycle the fans and operating compressor unexpectedly as control requirements dictate.

2.1 CONTROL SYSTEM

2.1.1 Introduction

⚠ CAUTION

Under no circumstances should anyone attempt to service the microprocessor components or Cab Command. Should a problem develop with the control system, contact your nearest Carrier Transicold dealer for replacement components.

The Control System consists of the microprocessor (Figure 1-3), Cab Command (Figure 2-1) and interconnecting wiring.

a. The Microprocessor includes the temperature control software and necessary input/output circuitry to interface with the unit controls.

b. The Cab Command is remotely mounted in the truck. The Cab Command includes the LCD display and keypad. The keypad and display serve to provide user access and readouts of microprocessor information. The information is accessed by keypad selections and viewed on the display.

2.1.2 Microprocessor

The microprocessor controls the following functions:

a. Maintains the box temperature at setpoint by regulating the cooling, heat, off mode and automatic defrost cycles.

b. Permanent displays the return air temperature and, on request, the setpoint temperature.

c. Digital display and selection of data.

For further details on digital message display, see section 2.7.

2.1.3 Cab Command

The Cab Command is mounted in the cab and allows the driver to carry out the control operations:

- manual start up and shut-down of the unit
- automatic start-up of the unit
- adjust the setpoint
- initiate manual defrost

The driver can display the box temperature, and see whether the setpoint is being maintained by checking the green indicator. The indicator lights up red in the event of a malfunction.

When the battery voltage is too low, a fail-safe system shuts down the unit. Unit restart is automatic and time-delayed if the voltage rises to the normal level.



Figure 2-1 Cab Command

a. Display

The digital display consists of 4 alphanumeric characters. The default value displayed is the box temperature. The microprocessor enables selection of the display in degrees Celsius or Fahrenheit. The display also includes settings for defrost operation (dF) and three LEDs:

8888	Readout
	Standby operation LED
	Road operation LED
! 	Unit operating data LED • Green : cycling (left-hand side) • Red : malfunction (right-hand side)

During start up the brightness of the display may be adjusted:

ON	Unit start-up
- +	Press during first 5 seconds the + or – key to increase or decrease the display brightness.

Unit operating LEDs

Green Light Status

Under normal operation, the green LED will indicate the temperature control status as follows:

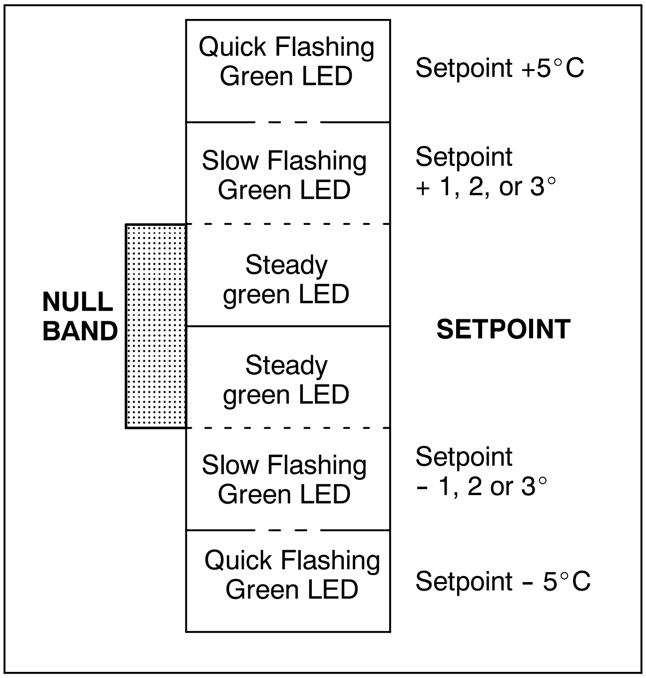
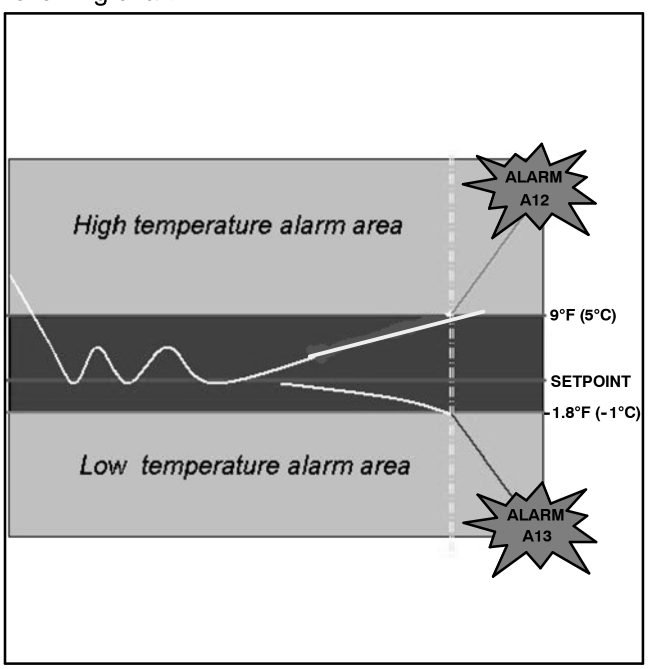


Figure 2-2 Green Light Status

Red Light Status

For all alarms, except out-of-range alarms A12 and A13 (See Table 2-2), the steady red unit indicating LED will light until the alarm is cleared. At that point the steady green indicator LED will light and the alarm will become inactive.

When the unit has been running for at least 15 minutes after setpoint has been reached and goes out-of-range, the red LED will flash according to the following chart:



b. Keypad

The keypad consists of six keys that enable the operator to activate various functions, display operating data and modify operating parameters.

	Manual defrost control key
ON	Unit start-up key
OFF	Unit shut-down key in standby or road mode On road operation, the unit can also be shut down with the ignition key.

Unit Data And Function Modification Keys

SET	The SET key, together with the + and - keys, enables display and modification of unit operating data. The display changes parameter each time the SET key is pressed.
-	Decrease key for selected data
+	Increase key for selected data

NOTE

If no buttons are depressed within 5 seconds of pressing the ON key, the system reverts to box temperature.

Additional Key Functions

To access additional key functions, press and hold the SET key for 5 seconds. The microprocessor will provide a set of additional functions as the SET key is pressed additional times after the 5 second hold. The sequence for the additional functions is as follows:

SET	Press SET for 5 sec. : this enables access to the alarm codes
- / +	Press to display the alarm list
SET	Press again to display software versions
+	Press to display the cab command software version
SET	Press again to display road hourmeter (Road LED ON)
SET	Press again to display standby hourmeter (Standby LED ON)
	Press to display the present interval between defrosts (min) as calculated by the microprocessor.
	Press to display the elapsed time (min) since the last defrost
SET	Press to return to box temperature

NOTE

If no buttons are depressed within 5 seconds of pressing the ON key, the system reverts to box temperature.

2.2 START-UP

2.2.1 Inspection

Before starting the truck engine or connecting standby power check the following

a. Check condenser coil for cleanliness.
b. Check condition of refrigerant hoses.
c. Check condition and tension of compressor belt(s).
d. Check condition of condenser fan blade, motor and brushes.
e. Check truck battery fluid level.
f. Check truck battery and terminal connections – clean and tighten as necessary.
g. Check defrost water drains from evaporator.
h. Check evaporator coil for cleanliness.
i. Check condition of evaporator blower wheels and motor.
j. Check that oil is visible in standby compressor sight glass.

2.2.2 Starting

CAUTION

If starting unit for the first time after installation the compressor pressure regulating valve will need to be set (refer to paragraph 4.11)

CAUTION

If starting unit for the first time after installation or starting after adding/removing an optional feature or if owner's operating parameters have changed the Configuration will need to be reset (refer to paragraph 2.5)

Depending on desired mode of operation, either start the vehicle engine or connect the standby power plug.

ON	Press the ON key to start the unit (start-up is time-delayed for 40 seconds). The digital display of the cab command displays the box temperature.
SET	Check that temperature set-point is correct by pressing the SET key; the set-point temperature is highlighted on the digital display.

NOTE

During start up, the evaporator motor speed increases continuously to selected speed over a 30 seconds time period.

CONNECT POWER FOR STANDBY

If the unit is to be operated in the standby mode, connect power as follows:

WARNING

Do not attempt to connect or remove power plug before ensuring the unit is OFF (press OFF key on Cab Command) and external power circuit breaker is open.

WARNING

Make sure the power plug is clean and dry before connecting to any power source

a. Check that the external power source corresponds to the characteristics of the unit (see paragraph 1.5.3 step c.). Make sure external power source circuit breaker is open.

b. Make sure unit is OFF by pressing the OFF button on the Cab Command.

c. Plug the power cord into unit receptacle.

d. Close external power source circuit breaker.

2.2.3 Start-up Process Prior To Software I.90

Start-up on Road with cool setpoint and box temp >-5°F (-20.6°C):

a. 0 time: ON key pushed

b. 40 seconds: HGS1 ON (pressure equalization)

c. 70 seconds: CLHR ON (Road clutch)

d. 80 seconds: HGS1 OFF/ fans ON (unit in cool)

Start-up on Standby with cool setpoint and box temp >-5°F (-20.6°C):

a. 0 time: ON key pushed

b. 15 seconds: HGS1 ON (pressure equalization)

c. 40 seconds: SCC ON (Standby contactor coil)

d. 50 seconds: HGS1 OFF/ fans ON (unit in cool)

Start-up on Road with heat setpoint and box temp >-5°F (-20.6°C):

a. 0 time: ON key pushed

b. 40 seconds: HGS1/ HGS2/ CLHR ON

c. 45 seconds: fans/ BPV ON (unit in heat)

Start-up on Standby with heat setpoint and box temp >-5°F (-20.6°C):

a. 0 time: ON key pushed

b. 10 seconds: HGS1/ HGS2 ON

c. 20 seconds: SCC/ fans/ BPV ON (unit in heat)

Start-up on Road with cool setpoint and box temp <-5°F (-20.6°C):

a. 0 time: ON key pushed

b. 40 seconds: CLHR / fans ON (unit in cool)

Start-up on Standby with cool setpoint and box temp <-5°F (-20.6°C):

a. 0 time: ON key pushed

b. 10 seconds: SCC/ fans ON (unit in heat)

Start-up on Standby with heat setpoint and box temp <-5°F (-20.6°C):

a. 0 time: ON key pushed

b. 10 seconds: HGS1/ HGS2/ SCC ON

c. 15 seconds: fans/ BPV ON (unit in heat)

Start-up on Road with heat setpoint and box temp <-5°F (-20.6°C):

a. 0 time: ON key pushed

b. 40 seconds: HGS1/ HGS2/ CLHR ON

2.2.4 Start-up Process Beginning With Software I.90

Start-up on Road with cool setpoint and box temp >-5°F (-20.6°C):

a. 0 time: ON key pushed

b. 20 seconds: HGS1 ON (pressure equalization)

c. 40 seconds: CLHR ON (Road clutch)

d. 50 seconds: HGS1 OFF/ fans ON (unit in cool)

Start-up on Standby with cool setpoint and box temp >-5°F (-20.6°C):

a. 0 time: ON key pushed

b. 15 seconds: HGS1 ON (pressure equalization)

c. 40 seconds (Prior to Software I: SCC ON (Standby contactor coil)

d. 50 seconds: HGS1 OFF/ fans ON (unit in cool)

Start-up on Road with heat setpoint and box temp >-5°F (-20.6°C):

a. 0 time: ON key pushed

b. 20 seconds: HGS1/ HGS2/ CLHR ON

c. 45 seconds: fans/ BPV ON (unit in heat)

Start-up on Standby with heat setpoint and box temp >-5°F (-20.6°C):

a. 0 time: ON key pushed

b. 10 seconds: HGS1/ HGS2 ON

c. 20 seconds: SCC/ fans/ BPV ON (unit in heat)

Start-up on Road with cool setpoint and box temp <-5°F (-20.6°C):

a. 0 time: ON key pushed

b. 20 seconds: CLHR / fans ON (unit in cool)

Start-up on Standby with cool setpoint and box temp <-5°F (-20.6°C):

a. 0 time: ON key pushed

b. 10 seconds: SCC/ fans ON (unit in heat)

Start-up on Standby with heat setpoint and box temp <-5°F (-20.6°C):

a. 0 time: ON key pushed

b. 10 seconds: HGS1/ HGS2/ SCC ON

c. 15 seconds: fans/ BPV ON (unit in heat)

Start-up on Road with heat setpoint and box temp <-5°F (-20.6°C):

a. 0 time: ON key pushed

b. 20 seconds: HGS1/ HGS2/ CLHR ON

2.2.5 Minimum Shut-Down Time On Standby

The minimum shut-down for the standby compressor is 5 minutes after reaching setpoint.

After this minimum shut-down period, the unit restarts when the temperature goes out of the cycling range by ± 1.8. 3.6 or 5.4°F (± 1. 2 or 3°C).

2.3 SETPOINT ADJUSTMENT

It is possible to increase or decrease the setpoint by whole numbers until the required setpoint is displayed. If display stays highlighted, this indicates the setpoint displayed has not been validated.

The new setting for the setpoint is validated by pressing the SET key.

SET	Displays the set-point temperature
-	Decrease the set-point
+	Increase the set-point
SET	Validates set-point temperature. Returns to display of the box temperature.

2.4 DEFROST

Defrost is fully automatic but can be manually controlled if authorized by the defrost thermostat.

The defrost cycles are fully managed by the integrated microprocessor.

During the defrost phase, the evaporator fan shuts down. The condenser fan is controlled by the microprocessor.

The end of the cycle is controlled by the defrost termination thermostat (DTT).

The defrost interval timer is reset to zero when the defrost cycle is terminated.

During the defrost phase, the readout of the cab command indicates “dF”.

a. Manual Defrost

Check that box temperature is 40°F (4.4°C) or lower.

	Press manual defrost key to initiate manual defrost.

b. Defrost Termination Safety

If the defrost cycle does not terminate after 45 minutes, the cycle terminates automatically and displays alarm code A14.

2.5 MICROPROCESSOR CONFIGURATION

⚠ CAUTION

If starting unit for the first time after installation or starting after adding/removing an optional feature or if Owners operating parameters have changed, the Configuration will need to be reset.

To access the configuration menu, press the **configuration button** (see Figure 2-3) located on the rear of Cab Command. Press the button only once to enter the menu. All changes are made with the keypad.

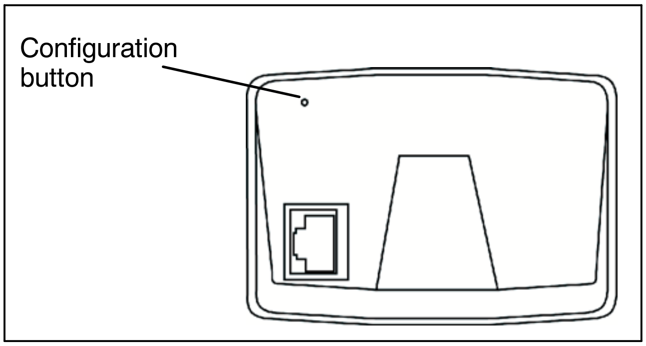


Figure 2-3 Configuration Button

TEMPERATURE UNIT

Ut°C : Celsius degree display

Ut°F : Fahrenheit degree display

Press the + and – keys to change Ut°C or Ut°F.

Press the SET key to validate and go to the next configuration.

UNIT VOLTAGE

PS12 : unit voltage 12 V

PS24 : unit voltage 24 V

Press the + and – keys to change PS12 or PS24.

Press the SET key to validate and go to the next configuration.

NUMBER OF EVAPORATOR FANS

FAn1 : 1 fan

FAn2 : 2 fans

FAn3 : 3 fans

Press the + and – keys to change FAn1, FAn2 or FAn3.

Press the SET key to validate and go to the next configuration.

FAN SPEED

SPd– : 1st speed mini

SPd= : 2nd speed medium

SPd≡ : 3rd speed maxi

Press the + and – keys to change SPd–, SPd= or SPd ≡

Press the SET key to validate and go to the next configuration.

2 or 3 ET MODE

2 Et : cool, null

3 Et : cool, null, heat

Press the + and – keys to change 2 Et or 3 Et.

Note : 50X : 3 ET

40X without condenser closing valve : 2 ET

40X with condenser closing valve : 3 ET

Press the SET key to validate and go to the next configuration.

OPTIONAL ROAD HEATING KIT

hrOF : option road heating kit not installed

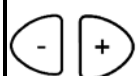
hrOn : option road heating kit installed

Press the + and – keys to change hrOF or hrOn.

Press the SET key to validate and go to the next configuration.

	OPTIONAL STANDBY HEAT KIT **hSOF : standby heating kit not installed** **hSOn : standby heating kit installed**
	Press the + and – keys to change hrOF or hrOn.
	Press the SET key to validate and go to the next configuration.

	DRAIN LINE HEATER **drOF : drain heater (option) not installed** **drOn : drain heater (option) installed**
	Press the + and – keys to change drOF or drOn.
	Press the SET key to validate and go to the next configuration.

	DOOR SWITCH **drOF : door switch (option) not installed** **drOn : door switch (option) installed**
	Press the + and – keys to change dOFF or d On.
	Press the SET key to validate and go to the next configuration.

NOTE

If no key is activated after validating a configuration, the system reverts to box temperature display and the configuration procedure is aborted. Only validated changes are recorded.

2.6 MODIFICATION OF PARAMETERS

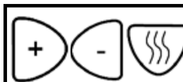
The procedure to adjust the unit functional parameters is as follows:

	Press the ON key of the controller

a.To Adjust The Brightness Of The Display:

Press + or – key. This step must be done within 5 seconds of pressing the ON key.

b.To Continue With Parameters:

	Press and hold + and – and Defrost keys in sequence.
	Modify parameters.
	Validate modified settings. Return to display of box temperature.

1) The minimum setpoint parameter is displayed. The minimum setpoint can be selected by scrolling through available options [–20.2°F (–29°C), 68°F (20°C), 32°F (0°C)] using the (+) or (–) keys. Factory setting is –20°F. Selection MUST be validated by pressing the SET key.
2) The maximum setpoint parameter is displayed. The maximum setpoint can be selected by scrolling through available options [68°F (20°C), 86°F (30°C)] using the (+) or (–) keys. Factory setting is 68°F. Selection MUST be validated by pressing the SET key.
3) The null mode differential temperature is displayed next. This setting determines the temperature difference between box temperature and setpoint that controls compressor cycling. The differential can be selected by scrolling through available options [1.8°F (1°C), 3.6°F (2°C), or 5.4°F (3°C)] using the (+) or (–) keys. Factory setting is 3.6°F (2°C). Selection MUST be validated by pressing the SET key.
4) The ON/OFF (Continuous airflow) parameter for the evaporator fans is displayed next. This feature determines whether the evaporator fan is on or off when the unit cycles off upon reaching setpoint. The factory setting is OFF. Change setting by using the (+) or (–) keys. Selection MUST be validated by pressing the SET key.
5) The return air temperature will be displayed after the above sequence.

c.Defrost Parameters

OFF	Shut-down unit.
(Defrost) + ON	Display parameters.
- / +	Modify parameters.
SET	Validate modified settings. Return to display of box temperature.

NOTE

If no buttons are depressed within 5 seconds of pressing the Defrost and On Keys (Step 2 of the above procedure) or modifying parameters, the Cab Command reverts to box temperature display and the procedure is aborted. Only validated changes are recorded

Defrost Interval

The defrost interval parameter is displayed next. This setting determines the length of time between defrosts:

0 : complete deletion of defrost.

AUT : The microprocessor calculates the time – factoring in length of last defrost, time between two defrost cycles in relation to setpoint and cargo.

0.5 to 0.9 : decreases the microprocessor calculated time between defrosts by 1/2 normal (0.5) to 9/10 normal (0.9).

1.1 to 1.5 : increases the microprocessor calculated time between defrosts by 1.1 times normal (1.1) to 1 1/2 times normal (1/5).

1 H, 2 H,... 6 H : Forced interval between each defrost expressed in hours.

2.7 ALARM DISPLAY

In the event of a malfunction the unit will be shut down and the Cab Command will immediately display an error message. See Section 2.7.2 for accessing alarm messages. The message will remain displayed until the malfunction is corrected. If standby power is connected and the malfunction is such that standby operation can be allowed, the unit will start in the standby mode. Error messages are provided in Table 2-1 while a listing of the alarm codes is provided in Table 2-2.

Table 2-1 Error Messages

EE	Malfunction : evaporator temperature probe
bAt	Low battery voltage low alarm (Refer to paragraph 2.7.1)
--- / --- / ---	Dual power supply (road and standby)
Err	Incorrect set-point setting
---	Setpoint lower than maximum setpoint but in the range of –20°F to 86°F (–29°C/+30°C)

2.7.1 Low Battery Voltage Alarm

If the battery voltage drops below 10 V the unit shuts down and the cab command displays the message "bAt". Unit restart is automatic and time-delayed if the voltage rises to the normal level.

2.7.2 Accessing Alarm Messages

Current alarms will be displayed with an "A" preceding the alarm number while past alarms will be displayed with a "P" preceding the alarm number. To access the alarm messages:

SET	Press SET for 5 seconds : enables access to alarm messages.
- / +	In the event of more than one alarm, press the + and – keys to list them.

2.7.3 Clearing Past Alarm Messages

The alarm list provides information on current alarms and past alarms which may be helpful in trouble shooting unit problems. Once all the alarm information has been noted and service is complete, the alarm list may be cleared.

a. To clear the past alarm messages:

ON - +	Press the ON, the + and the – keys at the same time.

a. To clear the active alarm messages:

Turn unit **OFF** and then back **ON**.

Table 2-2 Alarm Messages

A00	No malfunction. Unit in operation.
A01	Low pressure switch (LP) open
A02	High pressure switch (HP1) open
A03	Standby compressor thermal overload (PTO) open
A04	Road compressor clutch (CLHR) malfunction
A05	Standby contactor (MC) high amp draw
A06	Condenser fan motor (CFM) high amp draw
A07	Evaporator Fan low rotational speed
A08	Hot water solenoid valve (HWV) high amp draw (option)
A09	Hot gas valve (HGS1) high amp draw
A10	Quench valve (BPV) high amp draw
A11	Condenser pressure control valve (HGS2) high amp draw
A12	High temperature alarm
A13	Low temperature alarm
A14	Defrost cycle > 45 minutes
A15	Setpoint adjusted out of the range 20°F to 86°F (–29°C/+30°C)
A16	Evaporator drain line heater (DWR) malfunction (option)
A17	Transformer/Rectifier thermal overload (RBT) open
A18	Control fault, electric heat (option)
A20	Low pressure switch jumper (microprocessor terminal 6 to SP2) open
A21	Compressor contactor (MC) open circuit
A22	Condenser fan motor (CFM) open circuit
A23	Hot water solenoid valve (HWV) open circuit (option)
A24	Hot gas valve (HGS1) open circuit
A25	Quench valve (BPV) open circuit
A26	Condenser Pressure Control Valve (HGS2) open circuit
A27	Evaporator drain line heater (DWR) open circuit (option)
A28	Relay fault, electric heat (option)

2.8 STOPPING THE UNIT

OFF	Press the OFF key or turn off the ignition key.
ON	Unit start-up
THEN - +	Press the +, then – then DEFROST keys. All keys should be held momentarily after pressing in the correct sequence.
OR - +	Modify parameters. (See 1), 3) and 4) below)

SECTION 3

TEMPERATURE CONTROL

3.1 SEQUENCE OF OPERATION

General operation sequences for cooling, null, and heating are provided in the following paragraphs. The microprocessor automatically selects the mode necessary to maintain box temperature at setpoint.

3.1.1 Perishable Mode

The unit operates in the perishable mode with set points above 10°F (-12°C)

a. With return air temperature above setpoint and decreasing, the unit will be cooling with the compressor and evaporator fans operating. (See Section 1.8.1 for a description of the refrigeration circuit during cooling.) The condenser fan will operate under the control of the condenser pressure control switch (HP2). The green unit operating LED will operate in accordance with Figure 2-2.

b. If discharge temperature increases to the setpoint of the quench thermostat (BPT), the thermostat will close, energizing the quench valve (BPV). This will allow liquid into the suction line in order to cool compressor. Once the discharge temperature decreases to the setpoint of the BPT, the thermostat will open, DE-energizing the BPV.

c. If discharge pressure increases to the setting of the high ambient pressure switch (HP4), the thermostat will open, de-energizing (closing) the suction bypass valve (SBPV) and bringing the compressor regulating valve (CPR) into the circuit. Once the discharge pressure decreases to the setting of HP4, the thermostat will close, energizing the SBPV and the refrigerant will bypass the CPR.

d. Once temperature decreases to the setpoint the unit will enter the null mode. If the continuous air flow parameter is set to ON, the evaporator fans will continue to operate with all other components OFF. If the continuous air flow parameter is OFF, the evaporator fans and all other components will be OFF. A 5 minute delay is required before restart is allowed.

e. If temperature increases during the null mode, the unit will restart in cooling.

f. If temperature continues to decrease the unit will enter the heating mode with the compressor and evaporator fans operating and the hot gas solenoid valve (HGS1) energized (opened). The condenser fan and condenser pressure control valve (HGS2) will operate under the control of the condenser pressure control switch (HP2). (See Section 1.8.2 for a description of the refrigeration circuit during heat and defrost.)

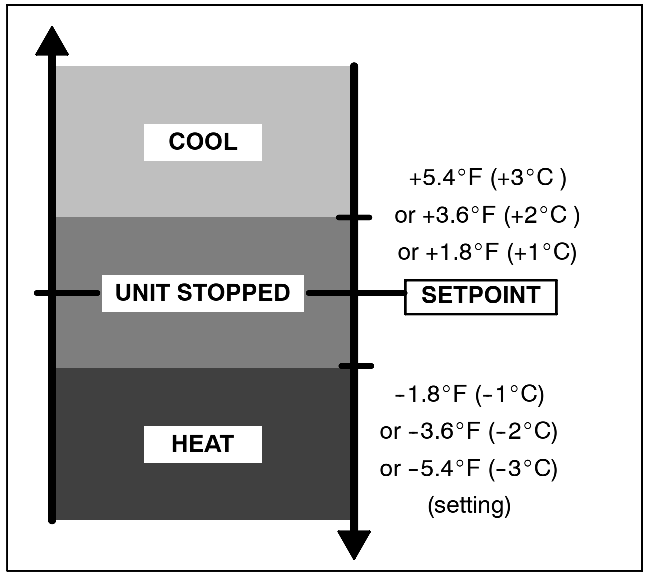


Figure 3-1 Operating Sequence - Perishable Mode

3.1.2 Frozen Mode

The unit operates in the frozen mode with setpoints at or below 10°F (-12°C). Operation in the frozen mode is the same as in the perishable mode except no heating takes place.

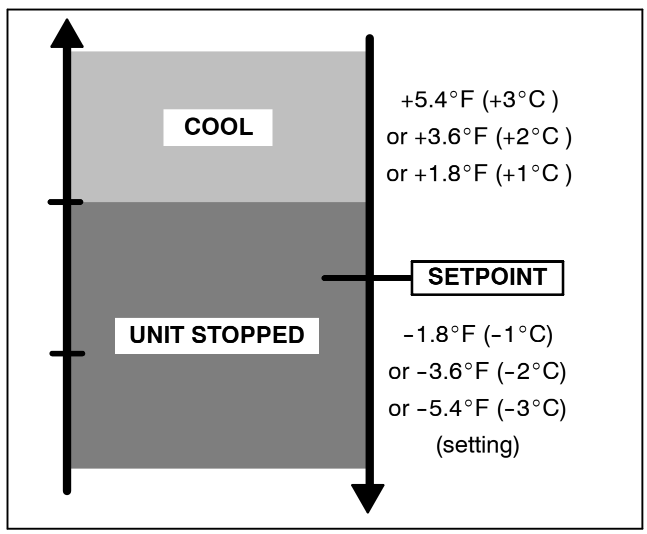


Figure 3-2 Operating Sequence - Frozen Mode

3.2 DEFROST CYCLE

Defrost is an independent cycle overriding cooling and heating functions to melt frost and ice from the evaporator when necessary. Defrost may be initiated by the microprocessor or manually by the operator once the defrost termination thermostat has closed at approximately 38°F (3.3°C). In defrost mode, the microprocessor displays “dF” on the cab command and set-point is no longer displayed.

During defrost, the evaporator fans shut down and operation of the condenser fan is controlled by the microprocessor. The end of the cycle is controlled by the opening of the defrost termination thermostat (See Section 1.5.2 for DTT settings. (See Section 1.8.2 for a description of the refrigeration circuit during heat and defrost.)

3.3 MINIMUM OFF TIME

Once the unit has cycled off, it will remain off for the minimum off time of 5 minutes. This prevents rapid cycling due to changes in air temperature. Air temperature in the box changes rapidly but it takes time for the product temperature to change.

SECTION 4
SERVICE

⚠ WARNING

Beware of unannounced starting of the unit. The unit may cycle the fans and operating compressor unexpectedly as control requirements dictate. To ensure unit will not start, place the EMERGENCY SWITCH (see Figure 1-1) in the OFF position. To ensure unit is without power, remove power plug and remove battery negative cable.

4.1 PREVENTATIVE MAINTENANCE

Regular servicing is required in order to optimize the life and reliability of your unit. The recommended scheduled maintenance intervals and categories are provided in Table 4-3 while descriptions of the service procedures to be carried out under each category are provided in Table 4-4

Table 4-1 Preventative Maint. After Start-up

Check condenser and evaporator fan rotation and for proper air flow.
Check cab command for proper unit cycling and correct display of all indicator lights.
Check for unusual noise or vibration
Check that refrigerant is visible in liquid line sight-glass.

Table 4-2 Preventative Maint. After 15 minutes or more of operation

Check that refrigerant is visible in liquid line sight-glass.
Check compressor oil level
Check for proper temperature control
Check temperature cycling operation
Put unit into manual defrost mode.
Verify unit terminates defrost mode.

Table 4-3 Preventive Maintenance schedule

Hours	Service A	Service B	Service C	Service D
100	▪			
1000	▪	▪		
2000	▪	▪	▪	
3000	▪	▪		
4000	▪	▪	▪	▪
5000	▪	▪		
6000	▪	▪	▪	
7000	▪	▪		

Table 4-4 Service Category Descriptions

Service A	1. Check the tension of the alternator belt(s). 2. Check that the vehicle engine runs correctly at low speed and that the compressor mounting kit is correctly tightened and that belt tension is correct. (Paragraph NO TAG) 3.Check the tightness of bolts and screws and that the unit is correctly fastened onto the box.
Service B	1. Clean condenser & the evaporator coils. (Paragraphs 4.15 & 4.16) 2. Replace the road compressor belt. 3. Check and, if required, replace the filter-drier. (Paragraph 4.7) 4. Check standby compressor oil level. Level should be from 1/4 to 1/2 sight glass. 5. Check the operation of cab command. 6. Check the defrost: ●Cut-in ●Fan shut-down ●Cut-out ●Defrost water drain(s) 7 .Check the water tightness of the emergency switch boot.
Service C	1 .Check the bearings of the belt tension pulley. If a spring is fitted, change spring. 2. Change the shockmounts (if any) installed on the road compressor mounting kit. 3. Check the operation of the evaporator and condenser fans. Change the condenser motor brushes. The evaporator of this unit is equipped with brushless fan motors therefore, brush maintenance is not required.. 4. Change the compressor oil. Use polyol ester oil (POE) approved by CARRIER. Refer to paragraph 1.5.1.
Service D	1. Change the removable fuses and capacitor (if any) in the control box.

4.2 INSTALLING R-404a MANIFOLD GAUGE SET

An R-404a manifold gauge/hose set with self-sealing hoses is required for service of models covered within this manual. The manifold gauge/hose set is available from Carrier Transicold. (Carrier Transicold P/N 07-00294-00, which includes items 1 through 6, Figure 4-1). To perform service using the manifold gauge/hose set, do the following:

4.2.1 Preparing Manifold Gauge/Hose Set For Use

a. If the manifold gauge/hose set is new or was exposed to the atmosphere it will need to be evacuated to remove contaminants and air as follows:

b. Back seat (turn counterclockwise) both field service couplers (see Figure 4-1) and midseat both hand valves.

c. Connect the yellow hose to a vacuum pump and an R-404a cylinder.

d. Evacuate to 10 inHg (254mmHg) and then charge with R-404a to a slightly positive pressure of 1.0 psig (0.07 Bar).

e. Front seat both manifold gauge set hand valves and disconnect from cylinder. The gauge set is now ready for use.

4.2.2 Connecting Manifold Gauge/Hose Set

To connect the manifold gauge/hose set for reading pressures, do the following:

a. Remove service valve stem cap and check to make sure it is backseated. Remove access valve cap.

b. Connect the field service coupler (see Figure 4-1) to the access valve.

c. Turn the field service coupling knob clockwise, which will open the system to the gauge set.

d. Read system pressures.

e. Repeat the procedure to connect the other side of the gauge set.

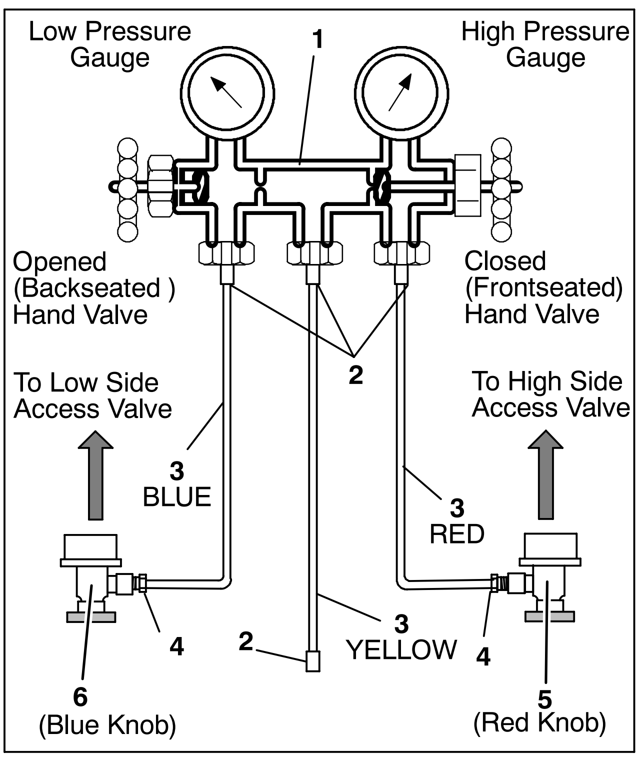
4.2.3 Removing the Manifold Gauge Set

1. While the compressor is still ON, backseat the high side service valve.
2. Midseat both hand valves on the manifold gauge set and allow the pressure in the manifold gauge set to be drawn down to low side pressure. This returns any liquid that may be in the high side hose to the system.

CAUTION

To prevent trapping liquid refrigerant in the manifold gauge set be sure set is brought to suction pressure before disconnecting.

3. Backseat the low side service valve. Backseat both field service couplers and frontseat both manifold set hand valves. Remove the couplers from the access valves.
4. Install both service valve stem caps and access valve caps (finger-tight only).



1. Manifold Gauge Set
2. Hose Fitting (0.5-16 Acme)
3. Refrigeration and/or Evacuation Hose
. (SAE J2196/R-134a)
4. Hose Fitting w/O-ring (M14 x 1.5)
5. High Side Field Service Coupler
6. Low Side Field Service Coupler

Figure 4-1 Manifold Gauge Set (R-404a)

4.3 REMOVING THE REFRIGERANT CHARGE

CAUTION

When working with refrigerant use safety glasses and gloves to avoid burns. Hoses and copper tubing can be hot when unit is running.

NOTE

Once the system is open, it must be evacuated and dehydrated. (See section 4.5)

NOTE

To avoid damage to the earth's ozone layer, use a refrigerant recovery system whenever removing refrigerant.

Connect a refrigerant recovery system (Carrier P/N MVS-115-F-L-CT (115V) or MVS-240-F-L-CT (240V)) to the unit to remove refrigerant charge. Refer to instructions provided by the manufacturer of the refrigerant recovery system.

4.3.1 Refrigerant Removal From a Non-operative Standby Compressor

To remove the refrigerant from a standby compressor that is not operational, do the following:

a. Attach a manifold gauge set to the standby compressor service valve access ports. Ensure both service valves are frontseated.
b. Recover refrigerant with a refrigerant recovery system.
c. Service or replace components as required and leak check the compressor. (See Section 4.4).

4.3.2 Pumping the Unit Down if Standby is Available

To service the filter-drier, moisture-liquid indicator, liquid line check valve, expansion valve, quench valve, evaporator coil, compressor pressure regulating valve, suction bypass valve, pump the refrigerant into the high side as follows:

a. Attach manifold gauge set to standby compressor service valves.
b. Start the unit and run in standby cooling mode for 10 to 15 minutes. Frontseat the king valve. Place the emergency switch in the OFF position when the suction reaches a positive pressure of 1.0 psig (0.01 bar).
c. Frontseat the standby suction service valve. The refrigerant will be trapped between the standby compressor suction service valve and the liquid line valve.
d. Before opening up any part of the system, a slight positive pressure should be indicated on the pressure gauge. If a vacuum is indicated, emit refrigerant by cracking the liquid line valve momentarily to build up a slight positive pressure.
e. When opening up the refrigerant system, certain parts may frost. Allow the part to warm to ambient temperature before dismantling. This avoids internal condensation which puts moisture in the system.
f. After repairs have been made, be sure to perform a refrigerant leak check (refer to paragraph 4.4), and evacuate and dehydrate the low side (refer to paragraph 4.5.4).
g. Check refrigerant charge (refer to paragraph 4.6.1).

4.3.3 Removing Complete Charge

Connect a refrigerant recovery system to the unit to remove refrigerant charge. Refer to instructions provided by the manufacturer of the refrigerant recovery system.

4.4 REFRIGERANT LEAK CHECKING

CAUTION

Refrigerant R404a is a blend. Charging as a vapor will change the properties of the refrigerant. Only liquid charging through the king valve is acceptable.

A refrigerant leak check should always be performed after the system has been opened to replace or repair a component. To check for leaks in the refrigeration system, perform the following procedure:

NOTE

Only refrigerant 404a should be used to pressurize the system. Any other gas or vapor will contaminate the system which will require additional purging and evacuation of the system.

a. The recommended procedure for finding leaks in a system is with an electronic leak detector (Carrier Transicold P/N 07-00295-00). Testing joints with soapsuds is satisfactory only for locating large leaks.

b. If system is without refrigerant or the low side has been pumped down, charge with refrigerant 404a to build up pressure between 30 and 50 psig (2 to 3.4 bar). Remove refrigerant cylinder and leak check all connections.

c. Remove test refrigerant using a refrigerant recovery system and repair any leaks. Evacuate and dehydrate the unit or low side as applicable. (Refer to paragraph 4.5)

4.5 EVACUATION AND DEHYDRATION

4.5.1 General

Moisture can seriously damage refrigerant systems. The presence of moisture in a refrigeration system can have many undesirable effects. The most common are copper plating, acid sludge formation, “freezing-up” of metering devices by free water, and formation of acids, resulting in metal corrosion.

4.5.2 Preparation

a. Evacuate and dehydrate only after pressure leak test. (Refer to paragraph 4.4).

b. Essential tools to properly evacuate and dehydrate any system include a good vacuum pump (5 cfm = $8m^3H$ volume displacement, P/N 07-00176-01) and a good vacuum indicator such as a thermocouple vacuum gauge (vacuum indicator). (Carrier P/N 0700414-00).

NOTE

Use of a compound gauge is not recommended because of its inherent inaccuracy.

c. Keep the ambient temperature above 60°F (15.6°C) to speed evaporation of moisture. if ambient temperature is lower than 60°F (15.6°C), ice might form before moisture removal is complete. Heat lamps or alternate sources of heat may be used to raise system temperature.

d. Additional time may be saved during a complete system pump down by replacing the filter-drier with a section of copper tubing and the appropriate fittings. Installation of a new filter-drier may be performed during the charging procedure.

4.5.3 Evacuation and Dehydration - Complete System.

a. Remove refrigerant using a refrigerant recovery system.

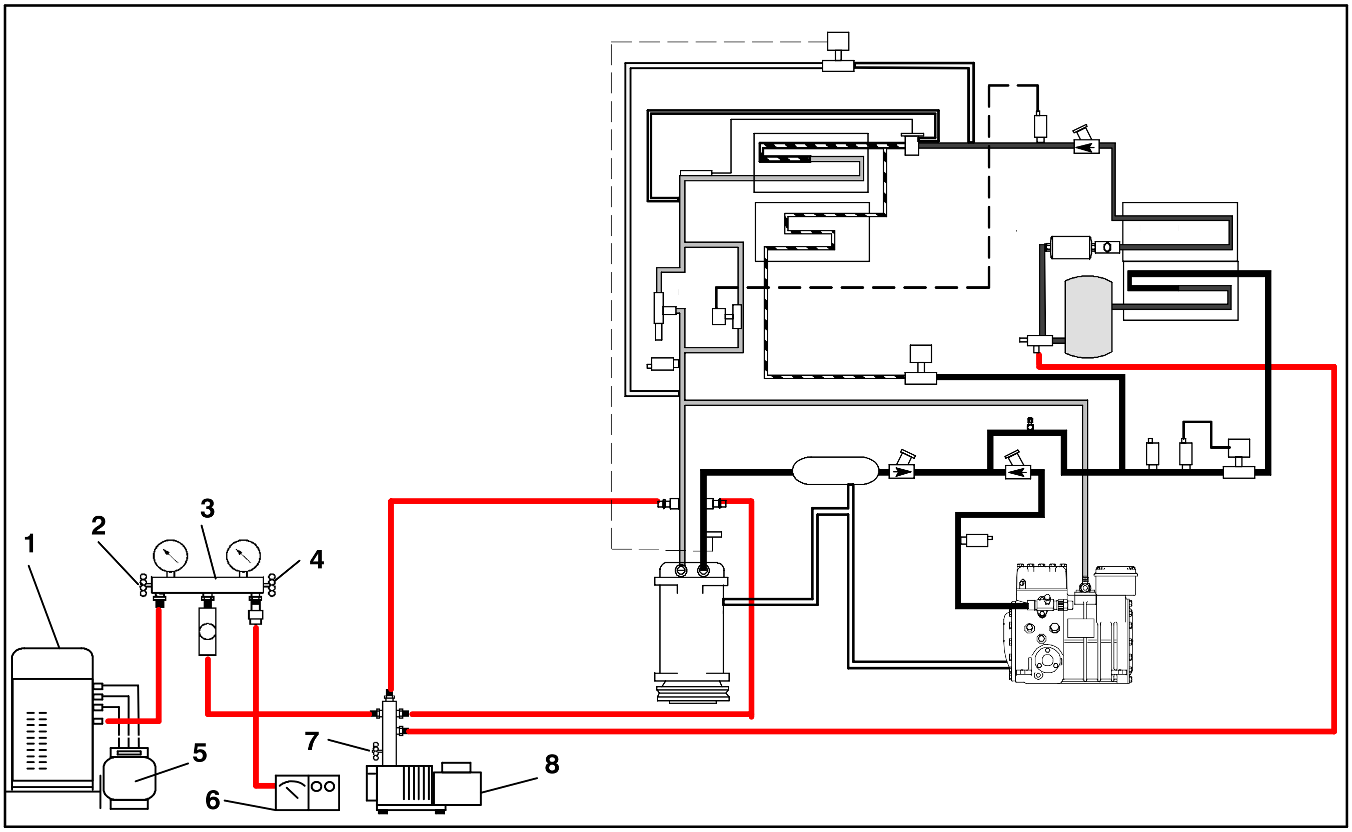
b. The recommended method to evacuate and dehydrate the system is to connect three evacuation hoses to the vacuum pump and refrigeration unit as shown in Figure 4-2 (do not use standard service hoses as they are not suited for evacuation purposes). Connect an evacuation manifold with special evacuation hoses to the vacuum pump, to the electronic vacuum gauge and to the refrigerant recovery system.

c. Test the evacuation system for leaks by backseating the unit service valves and drawing a deep vacuum with the vacuum pump and gauge valves open. Shut off the pump and check to see if the vacuum holds. Repair leaks if necessary.

d. Midseat the refrigerant system service valves.

e. Open the vacuum pump and electronic vacuum gauge valves, if they are not already open. Start the vacuum pump. Evacuate unit until the electronic vacuum gauge indicates 2000 microns. Close the electronic vacuum gauge and vacuum pump valves. Shut off the vacuum pump. Wait a few minutes to be sure the vacuum holds.

f. Break the vacuum with refrigerant 404a. Raise system pressure to approximately 2 psig (0.14 bar).



1 Refrigerant Recovery Unit	6 Electronic Vacuum Gauge
2 Suction Valve (Low Side)	7 Vacuum Pump Valve
3 Manifold Gauge Set	8 Vacuum Pump
4 Discharge Valve (High Side)	
5 Refrigerant Cylinder	

Figure 4-2 Vacuum Pump Connection

g. Remove refrigerant using a refrigerant recovery system.

h. Repeat steps e. to g.

i. If required, remove the copper tubing and install a new filter-drier. Evacuate unit to 500 microns. Close off vacuum pump valve and stop pump. Wait five minutes to see if vacuum holds. This checks for residual moisture and/or leaks.

j. With a vacuum still in the unit, the refrigerant charge may be drawn into the system from a refrigerant container on weight scales. See Table 1-1 for correct charge. Continue to paragraph 4.6.2.

4.5.4 Evacuation and Dehydration - Partial System.

NOTE

The following procedure applies to Standby units only. For units with only a road compressor follow procedure for complete system evacuation and dehydration (See Section 4.5.3)

a. If the refrigerant charge has been removed from the standby compressor for service, evacuate only the compressor by connecting the evacuation set-up at the compressor service valves. Follow evacuation procedures of the preceding paragraph except leave compressor service valves frontseated until evacuation is completed.

b. If refrigerant charge has been removed from the low side only, evacuate the low side by connecting the evacuation set-up at the standby compressor suction service valve and king valve except leave the service valves frontseated until evacuation is completed.

c. Once evacuation has been completed and the pump has been isolated, fully backseat the service valves to isolate the service connections and then continue with checking and, if required, adding refrigerant in accordance with normal procedures

4.6 CHARGING THE REFRIGERATION SYSTEM

CAUTION

Refrigerant R404a is a blend. Charging as a vapor will change the properties of the refrigerant. Only liquid charging through the king valve is acceptable.

4.6.1 Checking The Refrigerant Charge

Start unit in cooling mode. Run approximately ten minutes. Partially block off air flow to condenser coil increase the area blocked until compressor discharge pressure is raised to approximately 325 psig (22 bars).

The charge is correct if there are no bubbles at the liquid line sight glass.

4.6.2 Installing a Complete Charge (See Figure 4-3)

NOTE

The ambient (air entering the condenser) air temperature should be above 40°F (4.4°C)

a. Evacuate the refrigeration circuit and leave in a deep vacuum (refer to paragraph 4.5).

b. Place refrigerant 404a cylinder on scale. Connect the discharge gauge field coupler of the manifold test set to the king valve access port. Connect the suction pressure hose of the manifold gauge set to the manifold dead head port. Connect a charging line between the center tap of the second gauge set and the refrigerant drum. Midseat discharge knob. Open the liquid valve on the drum and purge all hoses. Frontseat discharge knob

c. Note weight of refrigerant cylinder.

d. Open liquid valve on refrigerant cylinder. Open king valve half way and allow the liquid refrigerant to flow into the unit until the correct weight of refrigerant has been added as indicated by scales. (See Section 1.5.1 for correct charge.)

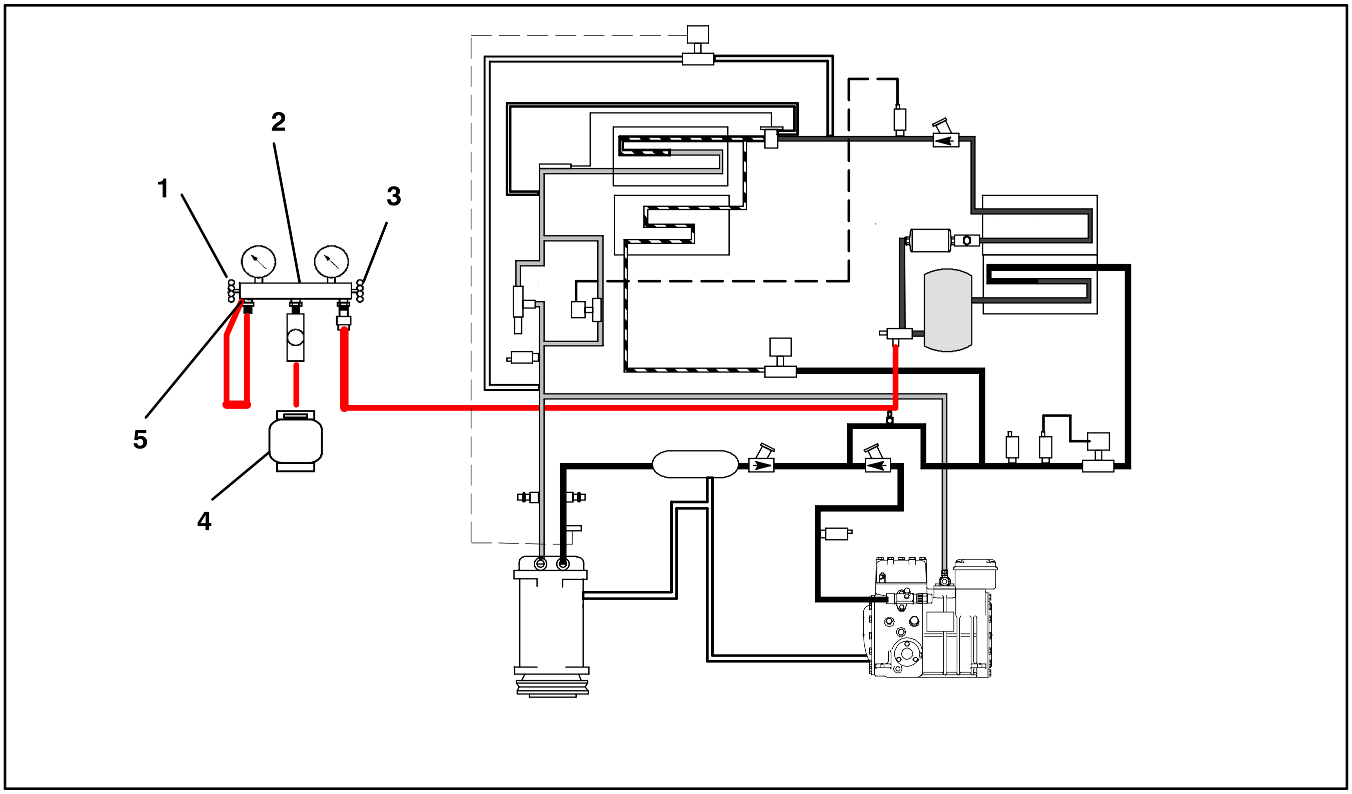
NOTE

It may be necessary to finish charging the unit using the partial charge method, due to pressure rise in the high side of the system. (Leave gauges and hoses in place and refer to paragraph 4.6.3)

e. If scale indicates the correct charge has been added, close liquid line valve on drum and manifold valves.

f. Backseat the king valve, remove charging hoses and check charge in accordance with paragraph 4.6.1.

g. Check for noncondensables.



1 Suction Valve (Low Side)
2 Manifold Gauge Set
3 Discharge Valve (High Side)
4 Refrigerant Cylinder
5 Dead Head Port

Figure 4-3 Procedure for Adding A Complete Charge

4.6.3 Adding a Partial Charge (See Figure 4-4)

⚠ CAUTION

Refrigerant R404a is a blend. Charging as a vapor will change the properties of the refrigerant. Only liquid charging through the king valve is acceptable.

NOTE

The ambient (air entering the condenser) air temperature should be above 40°F (4.4°C)

a. Place drum of refrigerant on scale and note weight. Backseat discharge and suction service valves and install a manifold gauge set in order to monitor system. Purge lines. Connect the discharge gauge of a second manifold test set to the king valve. Connect the suction pressure hose to manifold dead head port. Connect a charging line between the center tap of the second gauge set and refrigerant drum. Midseat discharge knob. Open the liquid valve on drum and purge all hoses. Frontseat discharge knob. See Figure 4-4.

b. Start the unit with the road compressor turning at 2400 rpm.

c. Check the sight glass to determine charge. See Section 4.6.1. If undercharged, proceed with step d.

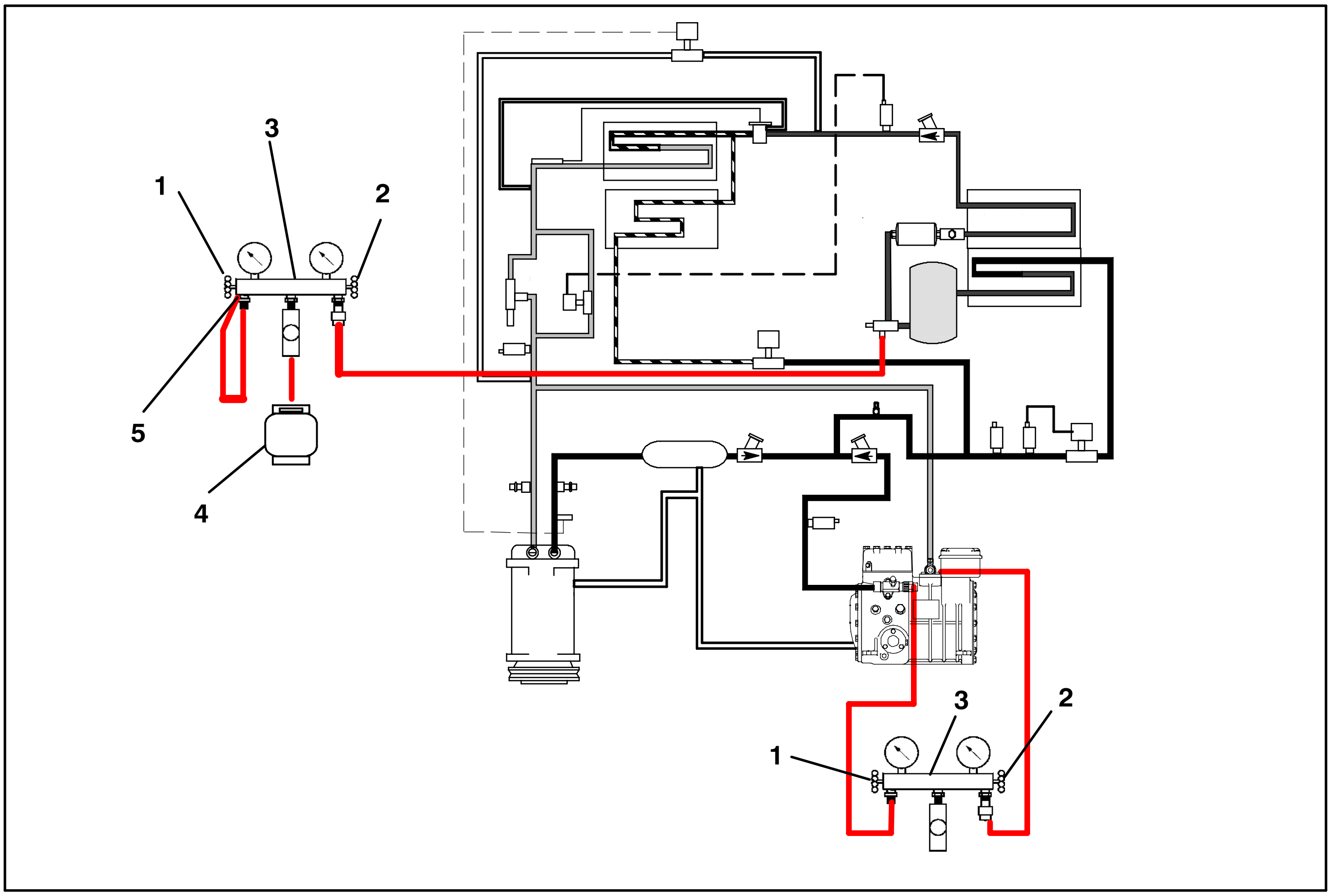
d. Front seat the king valve. Monitor the second set of manifold gauges. When the king valve pressure drops below the pressure in the refrigerant drum, midseat the manifold gauge set discharge valve and allow liquid refrigerant to flow into the system.

e. While monitoring the sight glass, carefully weigh refrigerant into the system. It is not possible to accurately determine when the system is full because unit is in discharge state; therefore, never allow more than 1 lb. (0.45 kg) of refrigerant into system at a time.

f. After monitoring 1 lb. (0.45 kg) of refrigerant into the system, close the valve of the manifold gauge set connected to the king valve. Open the king valve and allow the system to balance out to determine charge.

g. Follow the procedures of paragraph 4.6.1 and repeat above procedure as required to clear the sight glass.

h. Start unit and check for noncondensables.



1 Suction Valve (Low Side)
2 Discharge Valve (High Side)
3 Manifold Gauge Set
4 Refrigerant Cylinder
5 Dead Head Port

Figure 4-4 Partial Charge Procedure

4.7 CHECKING AND REPLACING FILTER-DRIER

4.7.1 Checking Filter-Drier

Check for any obstruction of the filter-drier by feeling the inlet and outlet connections of the liquid line on the filter cartridge. If the temperature of the outlet connection seems lower than the temperature of the inlet connection, replace the filter-drier.

4.7.2 Replacing Filter-Drier

Remove refrigerant charge (See section 4.3). Remove the drier mounting clip, then replace the filter-drier. Following drier replacement, evacuate and recharge unit (refer to sections 4.5 & 4.6).

4.8 HIGH PRESSURE (HP1), CONDENSER PRESSURE CONTROL (HP2), STANDBY HIGH PRESSURE (HP3)(STANDBY UNITS ONLY) SUCTION BYPASS PRESSURE (HP4) (50X UNITS ONLY), OR LOW PRESSURE SWITCHES

4.8.1 Removing Switches

a. A schraeder valve is located under each switch to allow removal and installation without removing the refrigerant charge.

b. Remove switch and test in accordance with paragraph 4.8.2.

c. Replace or reinstall switch.

4.8.2 Checking Switches

⚠ WARNING

Do not use a nitrogen cylinder without a pressure regulator. (See Figure 4-6) Cylinder pressure is approximately 2350 psi (160 bar). Do not use oxygen in or near a refrigerant system as an explosion may occur.

a. Remove switch as outlined in paragraph 4.8.1.

b. For high pressure, condenser pressure control and high ambient pressure switches, connect switch to a cylinder of dry nitrogen (see Figure 4-6). For the low pressure switch, also connect to a vacuum pump and gauge. Test both low and high pressure switches using method described in the following steps.

c. Set nitrogen pressure regulator or vacuum pump and gauge higher than cut-out or cut in point on switch being tested. Pressure switch settings points are provided in paragraph 1.5.2.

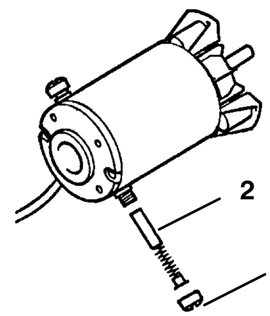
d. Close valve on cylinder and open bleed-off valve.

e. Open cylinder valve. While observing indicator (light or meter), slowly close bleed-off valve and increase pressure until the switch opens or closes. Slowly open bleed-off valve (to decrease pressure) until switch reverts to normal position.

f. If switch does not activate within tolerances provided, replace switch. Test new switch before installation.

4.9 CHECKING AND REPLACING CONDENSER FAN MOTOR BRUSHES

To maintain proper operation of the fan motors, the fan motor brushes should be checked periodically for cleanliness and wear .



1. Brush Cap 2. Brush

Figure 4-5 Fan motor brushes

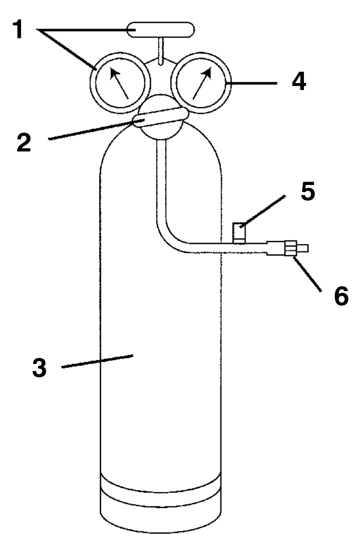
To check brushes proceed as follows :

a. With unit off and battery disconnected, remove brush cap (item 1, Figure 4-5; 2 per motor).

b. Remove brushes (item 2; 2 per motor) and check the length of the brush. If the length is less than 1/4 inch (6 mm) the brushes should be replaced.

c. Blow out the brush holder with low pressure air to remove any carbon dust in the holder. This dust could prevent a good contact between the brushes and commutator.

d. Remove the back cover of the motor and inspect the commutator. If the commutator is heavily grooved, polish it using fine sandpaper; do not use abrasive paper. Wipe out any accumulation of greasy material using a clean rag dampened with solvent. Reassemble the motor; install new brushes and replace cap.



1. Cylinder valve and gauge
2. Pressure regulator
3. Nitrogen cylinder
4. Pressure gauge (0 to 400 psig = 0 to 28 bars)
5. Bleed-off valve
6. 1/4 inch connection

Figure 4-6 Typical Setup For Testing Pressure Switches HP1, HP2, HP3 and HP4

4.10 HOT GAS SOLENOID VALVE (HGS1), CONDENSER PRESSURE CONTROL VALVE (HGS2) AND QUENCH VALVE (BPV)

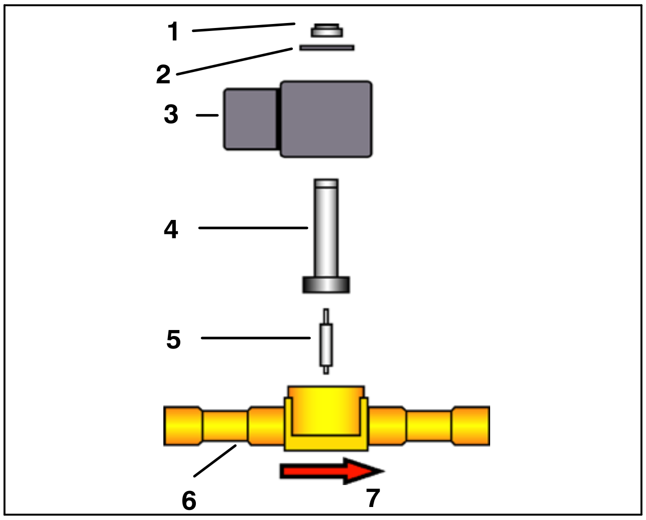
4.10.1 Replacing Solenoid Coil

It is not necessary to remove the refrigerant charge when replace the coil (see Figure 4-7).

a. Remove coil snap cap, voltage plate and coil assembly. Disconnect leads and remove coil junction box if necessary.

b. Verify coil type, voltage and frequency. This information appears on the coil voltage plate and the coil housing.

c. Place new coil over enclosing tube and then install voltage plate and snap cap.



1. Snap cap
2. Voltage plate
3. Coil assembly
4. Enclosing tube
5. Plunger assembly
6. Valve body assembly
7. Direction of flow

Figure 4-7 Hot Gas Valve, Condenser Pressure Control Valve, Quench Valve or Suction Bypass Valve (50X Only) (Hot Gas Valve Shown)

4.10.2 Replacing Valve Internal Parts

a. Remove the refrigerant charge for high side components or pump down to receiver if servicing low side components. (Refer to paragraph 4.3).

b. Remove coil snap cap, voltage cover and coil assembly. For SBPV valve, remove the head of the valve body. Remove the enclosing tube.

c. Check for foreign material in valve body.

d. Check for damaged plunger and O-ring. If O-ring is to be replaced, always put refrigerant oil on O-rings before installing.

CAUTION

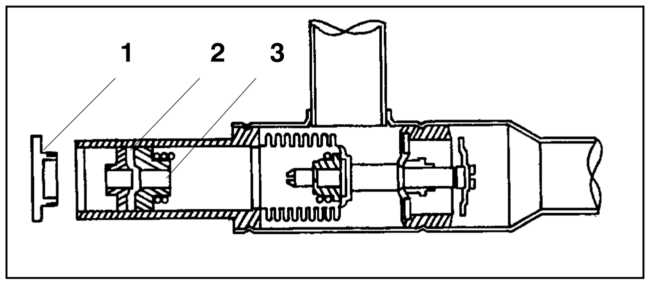
Do not damage or over tighten the enclosing tube assembly. Also make sure all parts are placed in the enclosing tube in proper sequence to avoid premature coil burn-out.

e. Tighten enclosing tube. If valve has been removed from the circuit, check for leaks.

f. Install coil assembly, voltage cover and snap cap.

g. Evacuate, dehydrate and recharge unit. Refer to paragraphs 4.5.3 and 4.6.2.

h. Start unit and check operation.



1. Cap
2. Jam Nut
3. Set Screw

Figure 4-8 Compressor Pressure Regulating Valve (CPR)

4.11 ADJUSTING THE COMPRESSOR PRESSURE REGULATING VALVE (CPR)

When adjusting the compressor pressure regulating valve (CPR) (see Figure 4-8), the unit must be running in heating or defrost mode. This will ensure a suction pressure above the proper CPR setting. To adjust the CPR valve, proceed as follows :

NOTE

In order to adjust the CPR on the 50X units the high ambient pressure switch (HP4) inside the evaporator must be disconnected from the harness in order to de-energize the normally closed suction bypass valve (SBPV). The SBPV will close and the CPR may be adjusted.

a. Install a gauge on the suction line .

b. Remove cap from CPR valve.

c. With an 8 mm Allen wrench, loosen the jam nut.

d. Using the 8 mm Allen wrench, adjust the set screw. To raise the suction pressure turn the set screw clockwise; to lower the suction pressure, turn counterclockwise. Refer to paragraph 1.5.2 for CPR valve setting.

e. When the setting has been adjusted, tighten the jam nut securely against the set screw. This will prevent any movement of the set screw due to vibrations in the unit. Replace the cap.

4.12 THERMOSTATIC EXPANSION VALVE

MOP expansion valve characteristics :

•Rule : in order to avoid compressor overcharge, a MOP expansion valve (expansion valve with limited flow) is used.

•Operating : the expansion valve will not open more than the MOP setpoint. Any temperature increase at the bulb should not open the expansion valve further.

The thermal expansion valve is an automatic device which maintains constant superheat of the refrigerant gas leaving the evaporator regardless of suction pressure. The valve functions are: (a) automatic response of refrigerant flow to match the evaporator load and (b) prevention of liquid refrigerant entering the compressor.

Unless the valve is defective, it requires no adjustment, but maintenance must be done every year in order to clean the orifice strainer. Refer to paragraph 4.12.3.

4.12.1 Replacing Expansion Valve

a. Pump the unit down. Refer to paragraph 4.3.2.

b. Remove insulation from expansion valve bulb and then remove bulb from suction line.

c. Loosen inlet nut and unbraze equalizer line and outlet line from expansion valve.

d. The thermal bulb is located below the center of the suction line. This area must be clean to ensure positive bulb contact. Strap thermal bulb to suction line and insulate both.

e. Braze the equalizer tubes to expansion valve.

f. Evacuate, dehydrate and recharge unit.

g. Check superheat (refer to paragraph 1.5.2).

4.12.2 Measuring superheat

a. Remove insulation from expansion valve bulb and suction line. See Figure 4-9

b. Loosen one TXV bulb clamp and make sure area under clamp (above TXV bulb) is clean.

c. Place thermocouple above (parallel to) the TXV bulb and then secure loosened clamp making sure both bulbs are firmly secured to suction line as shown in Figure 4-9

d. Connect an accurate gauge to the ¼" port on the suction service valve.

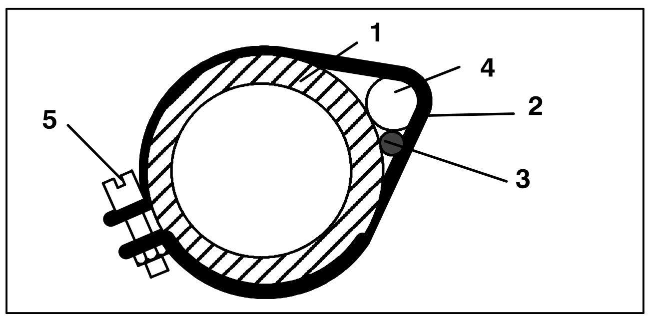
e. Run unit until stabilized at -4°F (-20°C) box temperature.

f. From the temperature/pressure chart (Table 4-5), determine the saturation temperature corresponding to the evaporator outlet pressure.

g. Note the temperature of the suction gas at the expansion valve bulb.

h. Subtract the saturation temperature determined in Step f. from the average temperature measured in Step g.. The difference is the superheat of the suction gas. Refer to paragraph 1.5.2 for superheat setting.

i. If required adjust superheat by turning the adjusting screw located under the cap on the side of the valve.



1. Suction Line (end view)	3. Thermocouple
2. TXV Bulb Clamp	4. TXV Bulb
	5. Nut and Bolt (Clamp)

Figure 4-9 Thermostatic Expansion Valve Bulb And Thermocouple

4.12.3 Checking the TXV Orifice Strainer

Pump the unit down (refer to paragraph 4.3.2). Remove the bottom connection on the TXV. Remove the strainer and check for obstruction or damage. Clean or replace strainer assembly and tighten connection at bottom of valve. Evacuate unit (refer to paragraphs 4.5.4).

4.13 COMPRESSOR OIL TYPE

The compressor(s) are supplied with CARRIER POLYESTER (POE) oil. Ensure compressor is marked with a factory sticker indicating the correct oil has been installed. Oils of PAG type are strictly incompatible with the operation of this unit, never use an oil other than that approved by CARRIER.

4.14 MICROPROCESSOR

Although there is less danger of electrical static discharge (ESD) damage in the outdoor environment, where the processor is likely to be handled, proper board handling techniques should be stressed. Boards should always be handled by their edges, in much the same way one would handle a photograph. This not only precludes the possibility of ESD damage, but also lowers the possibility of physical damage to the electronic components. Although the microprocessor boards are fairly rugged when assembled, they are more fragile when separated and should always be handled carefully.

When welding is required on the unit frame, or on the front area of the trailer, ALL wiring to the microprocessor MUST be disconnected. When welding is performed on other areas of the truck and van, the welder ground connection MUST be in close proximity to the area being welded. It is also a good practice to remove both battery cables before welding on either the unit frame or the truck to prevent possible damage to other components such as the alternator and voltage regulator.

4.15 EVAPORATOR COIL CLEANING

The use of recycled cardboard cartons is increasing. The recycled cardboard cartons create much more fiber dust during transport than ”new” cartons. The fiber dust and particles are drawn into the evaporator where they lodge between the evaporator fins. If the coil is not cleaned on a regular basis, sometimes as often as after each trip, the accumulation can be great enough to restrict air flow, cause coil icing, repetitive defrosts and loss of unit capacity. Due to the ”washing” action of normal defrost the fiber dust and particles may not be visible on the face of the coil but may accumulate deep within.

It is recommended to clean an the evaporator coil on a regular basis, not only to remove cardboard dust, but to remove any grease oil film which sometimes coats the fins and prevents water from draining into the drain pan.

Cardboard fiber particles after being wetted and dried several times can be very hard to remove. Therefore, several washings may be necessary.

a. Spray coil with a mild detergent solution such as any good commercial-grade automatic dish washer detergent and let the solution stand for a few minutes. Reverse flush (opposite normal air flow) with clean water at mild pressure. A garden hose with spray nozzle is usually sufficient. Make sure drain lines are clean.

b. Run unit until defrost mode be initiated to check for proper draining from drain pan.

4.16 CONDENSER COIL CLEANING

Remove all foreign material from the condenser coil by reversing the normal air flow. (Air is pulled in through the front.) Compressed air or water may be used as a cleaning agent. It may be necessary to use warm water mixed with any good commercial dishwasher detergent. Rinse coil with fresh water if a detergent is used.

Table 4-5. R-404a Temperature-Pressure Chart

Temperature		Pressure			Temperature		Pressure		
°F	°C	Psig	Kg/cm²	Bar	°F	°C	Psig	Kg/cm²	Bar
-40	-40	4.5	0.32	0.31	32	0	72.5	5.10	5.00
-35	-37	7.1	0.50	0.49	34	1	75.6	5.32	5.21
-30	-34	9.9	0.70	0.68	36	2	78.8	5.54	5.43
-25	-32	12.9	0.91	0.89	38	3	82.1	5.77	5.66
-20	-29	16.3	1.15	1.12	40	4	85.5	6.01	5.90
-18	-28	17.7	1.24	1.22	42	6	89.0	6.26	6.14
-16	-27	19.2	1.35	1.32	44	7	92.5	6.50	6.38
-14	-26	20.7	1.46	1.43	46	8	96.2	6.76	6.63
-12	-24	22.3	1.57	1.54	48	9	99.9	7.02	6.89
-10	-23	23.9	1.68	1.65	50	10	103.7	7.29	7.15
-8	-22	25.6	1.80	1.77	55	13	115.4	8.11	7.96
-6	-21	27.3	1.92	1.88	60	16	126.1	8.87	8.69
-4	-20	29.1	2.05	2.01	65	18	137.4	9.66	9.47
-2	-19	30.9	2.17	2.13	70	21	149.4	10.50	10.30
0	-18	32.8	2.31	2.26	75	24	162.1	11.40	11.18
2	-17	34.8	2.45	2.40	80	27	175.5	12.34	12.10
4	-16	36.8	2.59	2.54	85	29	189.6	13.33	13.07
6	-14	38.9	2.73	2.68	90	32	204.5	14.38	14.10
8	-13	41.1	2.89	2.83	95	35	220.2	15.48	15.18
10	-12	43.3	3.04	2.99	100	38	236.8	16.65	16.33
12	-11	45.6	3.21	3.14	105	41	254.2	17.87	17.53
14	-10	48.0	3.37	3.31	110	43	272.4	19.15	18.78
16	-9	50.4	3.54	3.47	115	46	291.6	20.50	20.11
18	-8	52.9	3.72	3.65	120	49	311.8	21.92	21.50
20	-7	55.5	3.90	3.83	125	52	332.9	23.41	22.95
22	-6	58.1	4.08	4.01	130	54	355.0	24.96	24.48
24	-4	60.9	4.28	4.20	135	57	378.1	26.58	26.07
26	-3	63.7	4.48	4.39	140	60	402.3	28.28	27.74
28	-2	66.5	4.68	4.59	145	63	427.6	30.06	29.48
30	-1	69.5	4.89	4.79	150	66	454.0	31.92	31.30

Table 4-6 Sensor Resistance (RAS)

Temperature		RAS Resistance In Ohms	Temperature		RAS Resistance In Ohms
°C	°F		°C	°F	
-28.9	-20	165,300	21.1	70	11,900
-23.3	-10	117,800	25	77	10,000
-17.8	0	85,500	26.7	80	9,300
-12.2	10	62,400	32.2	90	7,300
- 6.7	20	46,300	37.8	100	5,800
- 1.1	30	34,500	43.3	110	4,700
0	32	32,700	48.9	120	3,800
4.4	40	26,200	90	194	915
10.0	50	19,900	100	212	680
15.6	60	15,300	130	266	301
			150	302	186

SECTION 5

TROUBLESHOOTING

WARNING

Beware of unannounced starting of the unit. The unit may cycle the fans and operating compressor unexpectedly as control requirements dictate. To ensure unit will not start, place the EMERGENCY SWITCH (see Figure 1-1) in the OFF position. To ensure unit is without power, remove power plug and remove battery negative cable.

CAUTION

Under no circumstances should anyone attempt to service the microprocessor (see section 4.14). Should a problem develop with the microprocessor, contact your nearest Carrier Transicold dealer for replacement.

5.1 INTRODUCTION

Under normal circumstances, unit problems will be indicated by an active or inactive alarm in the alarm list. Suggested troubleshooting actions for each alarm indication are provided in Table 5-1. Suggested corrective actions for mechanical type problems are listed under subject headings in Table 5-2.

Table 5-1 Alarm Indications

ALARM	Description	CORRECTIVE ACTION	Reference Paragraph
A00	No Malfunction	All components functioning normally	--
A01	Low Pressure Switch (LP) Open (Road)	Unit undercharged	4.6.1
		Liquid line filter-drier restricted	4.7
		TXV strainer plugged with foreign material/ice.	4.12.3
		TXV malfunction	4.12
		Verify operation of evaporator fans.	--
		Failed switch	4.8.2
A02	High Pressure Switch (HP1) Open	Unit overcharged	4.6.1
		Verify operation of condenser fan	--
		Noncondensibles in system	4.3.3
		Discharge check valve failed closed (standby or road)	Replace
		Failed switch	4.8.2
A03	Standby Compressor Thermal Overload (PTO) open	Check liquid injection valve	
		Electric line voltage low	1.5.3
A04	Road Compressor Clutch (CLHR) Malfunction	Current draw of road clutch coil either high or low	Replace
A05	Standby Contactor (MC) high amp draw	Current draw of contactor coil high or low (0.2 amps - 3 phase; 0.5 amps - 1 phase)	--
		Verify plunger moves freely	--
		Replace contactor	--
A06	Condenser Fan Motor (CFM) high amp draw	Verify motor rotates freely	--
		Verify condition of brushes	4.9
		Replace motor	--
A07	Evaporator Fan Speed	Verify microprocessor configuration	2.5
		Check fan motor output wires Verify fan motor rotation.	--
A08	Hot Water Solenoid (HWV) high amp draw	Current draw of coil high or low	--
		Replace coil	--

Table 5-1 Alarm Indications – Continued

ALARM	Description	CORRECTIVE ACTION	Reference Paragraph
A09	Hot Gas Valve (HGS1) high amp draw	Current draw of coil high or low (approx 1.6 amp)	--
		Replace coil	4.10.1
A10	Quench Valve (BPV) high amp draw	Current draw of coil high or low (approx 1.2 amp)	--
		Replace coil	4.10.1
A11	Condenser Pressure Control Valve (HGS2) high amp draw	Current draw of coil high or low (approx 1.6 amp)	--
		Replace coil	4.10.1
A12	Out–of–Range – High Temperature	Unit out of range for 15 minutes	Verify Setting
		Verify cooling operation of unit	--
		Hot gas solenoid open	4.10
A13	Out–of–Range Low Temperature	Unit out of range for more than 15 minutes	Verify Setting
		Verify heating operation of unit	--
		Heating option not active (Set Configuration)	2.5
A14	Defrost Cycle >45 minutes	Unit terminated defrost after 45 minutes	--
		Verify HGS1/HGS2 valve operation	4.10
A15	Setpoint out of range	Operator entered invalid setpoint (outside of range)	2.3
		Verify configuration settings	2.5
A16	Evaporator drain line heater (DWR) malfunction	Replace heater High amp draw	--
A17	Transformer/Rectifier Thermal Overload (RBT) Open	Line voltage low	Correct
		Transformer winding open	Replace
		High load on rectification system	Correct
A18	Electrical Heating Relay (Future)	Relay shorted	Replace
		Wiring shorted	Correct
A21	Compressor Contactor (MC) Open Circuit	Contactor coil open circuit	Replace
		Wiring to coil open	Check
A22	Condenser Fan Motor (CFM) Open Circuit	Condenser fan motor defective	4.9
		Wiring to motor open	Check
A23	Hot Water Solenoid Valve (HWV) Open Circuit	Valve coil shorted	Replace
		Wiring to coil open	Check
A24	Hot Gas Valve (HGS1) Open Circuit	Valve coil shorted	4.10.1
		Wiring to coil open	Correct
A25	Quench Valve (BPV) Open Circuit	Valve coil shorted	Replace
		Wiring to coil open	Correct
A26	Condenser Pressure Control Valve (HGS2) Open Circuit	Valve coil shorted	4.10.1
		Wiring to coil open	Correct
A27	Evaporator Drain Line Heater (DWR) Open Circuit	Evaporator drain heater shorted	Replace
		Verify wiring to heater	Correct
A28	Heating Relay (EHR) Open Circuit (Future)	Relay open circuit	Replace
		Wiring to coil open	Correct

Table 5-1 Alarm Indications – Continued

ALARM	Description	CORRECTIVE ACTION	Reference Paragraph
EE	Return Air Sensor	Return air sensor defective	Replace
bAt	Low Battery Voltage	Vehicle battery voltage low	Correct
– – – – – – – – –	Using Road & Standby operation at the same time.	If operating on road, disconnect standby power supply	– –
		If operating on standby, shut down vehicle engine.	– –
Err	Setpoint above maximum.	Programming error, reset.	2.3
– – –	Setpoint below minimum.	Programming error, reset.	2.3

Table 5-2 Mechanical Indications

INDICATION/TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
5.2 REFRIGERATION **5.2.1 Unit Will Not Cool**		
Compressor malfunction	Compressor drive (clutch) defective Compressor defective	Replace
Refrigeration system	Defrost cycle has not terminated Abnormal pressure Hot gas solenoid malfunction (HGS1)	5.2.5 5.2.6 4.10
5.2.2 Unit Runs But Has Insufficient Cooling		
Compressor	Compressor defective	Replace
Refrigeration system	Abnormal pressure Expansion valve malfunction No or restricted evaporator airflow	5.2.6 5.3.1 5.3
5.2.3 Unit Operates Long or Continuously in Cooling		
Box	Hot Load Defective box insulation or air leak	Insufficient pull down time Correct
Refrigeration system	Abnormal pressure Temperature controller malfunction	5.2.6 5.2.8
Compressor	Defective	Replace
5.2.4 Unit Will Not Heat or Heating Insufficient		
Refrigeration	Abnormal pressure Temperature controller malfunction Hot gas solenoid malfunction (HGS1)	5.2.6 5.2.8 4.10
Compressor	Compressor drive (clutch) defective Compressor defective	Check Replace
5.2.5 Defrost Malfunction		
Automatic defrost will not initiate	Defrost thermostat (DTT) open or defective Hot gas valve malfunction Defrost disabled through cab command	Replace 4.10 2.4
Manual defrost will not initiate	Microprocessor defective Defrost thermostat (DTT) open or defective	Replace Replace
Defrost cycle initiates but does not defrost	Hot gas solenoid malfunction (HGS1) Condenser Pressure Control valve malfunction (HGS2)	4.10 4.10
Frequent defrost	Wet load Defrost settings set to low.	– – 2.4
Does not terminate or cycles on defrost	Defrost thermostats (DTT) shorted closed	Replace

Table 5-2 Mechanical Indications – Continued

INDICATION/TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
5.2.6 Abnormal Pressure **5.2.6.1 Cooling**		
High discharge pressure	Condenser coil dirty Noncondensibles or refrigerant overcharge Condenser fan/motor defective	4.16 4.6.1 4.9
Low discharge pressure	Compressor defective Hot gas solenoid malfunction Low refrigerant charge	Replace 4.10 4.6.1
High suction pressure	Compressor defective Hot gas solenoid malfunction Compressor pressure regulator misadjusted (CPR)	Replace 4.10 4.11
Low suction pressure	Filter–drier partially plugged Low refrigerant charge Expansion valve malfunction No evaporator air flow or restricted air flow Excessive frost on coil	4.7 4.6.1 5.3.1 5.3 Check
Suction and discharge pressures tend to equalize when unit is operating	Compressor defective Hot gas solenoid malfunction	Replace 4.10
5.2.6.2 Heating		
High discharge pressure	Overcharged system Condenser fan or HP2 pressure switch defective Noncondensibles in system Condenser motor/fan defective HGS2 closed	4.6.1 4.8 4.3.3 4.9
Low discharge pressure	Compressor defective Hot gas valve malfunction	Replace 4.10
Low suction pressure	Low refrigerant charge Compressor pressure regulating valve misadjusted (CPR) Condenser Pressure Regulating valve fault (HGS2)	4.6.1 4.11 4.10
5.2.7 Abnormal Noise		
Compressor	Loose mounting bolts Worn bearings Worn or broken valves Liquid slugging Insufficient oil	Tighten Replace Replace 5.3.1 Check
Condenser or evaporator fan	Loose shroud Bearings defective Fan loose on shaft Bent shaft	Check Check Check
5.2.8 Cab Command Malfunction		
Cab Command non–operational	Microprocessor fuse open Microprocessor malfunction Microprocessor/Cab command cable	Replace Replace Check
5.3 No Evaporator Air Flow or Restricted Air Flow		
Evaporator coil blocked	Heavy frost on coil Coil dirty	Check 4.15
No or partial evaporator air flow	Evaporator fan loose or defective Evaporator fan rotating backwards Evaporator air flow blocked in box Fan motor(s) malfunction	Check Check Check Replace

Table 5-2 Mechanical Indications – Continued

INDICATION/TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
5.3.1 Expansion Valve		
Low suction pressure with high superheat	Low refrigerant charge External equalizer line plugged Ice wax, oil or dirt plugging valve strainer Broken capillary Superheat setting too high	4.6.1 Repair 4.12.3 Repair 4.12.2
Low superheat and liquids lugging in compressor	Superheat setting too low External equalizer line plugged Pin and seat of expansion valve eroded or held open by foreign material	4.12.2 Repair 4.12
Fluctuating suction pressure	Improper bulb location or installation Insulation missing from sensing bulb Low superheat setting	4.12 Replace 4.12.2
High superheat	Expansion valve setting	4.12.2
5.3.2 Malfunction Hot Gas Solenoid or Condenser Pressure Regulating Valve		
Valve does not function properly	No power to valve Improper wiring or loose connections Valve improperly assembled Coil or coil sleeve improperly assembled Movement of plunger restricted due to: a. Corroded or worn parts b. Foreign material lodged in valve c. Bent or dented enclosing tube	Check Check 4.10
Valve shifts but refrigerant continues to flow	Foreign material lodged under seat Defective seat	4.10
5.3.3 Standby Compressor Malfunction		
Standby compressor fails to start	Motor contactor defective Motor Overload open Improper power supply 5–minute timer active	Replace Check Correct Check
Standby compressor fails to start 1∅ Only	Defective start capacitor Defective start relay	Check/Replace Replace
Standby motor starts, then stops	Motor Overload open	Check
Standby motor starts, then stops – 1∅ Only	Defective start capacitor Defective start relay	Check/Replace Replace

SECTION 6

SCHEMATIC DIAGRAMS

WARNING

Beware of unannounced starting of the unit. The unit may cycle the fans and operating compressor unexpectedly as control requirements dictate. To ensure unit will not start, place the EMERGENCY SWITCH (see Figure 1-1) in the OFF position. To ensure unit is without power, remove power plug and remove battery negative cable.

CAUTION

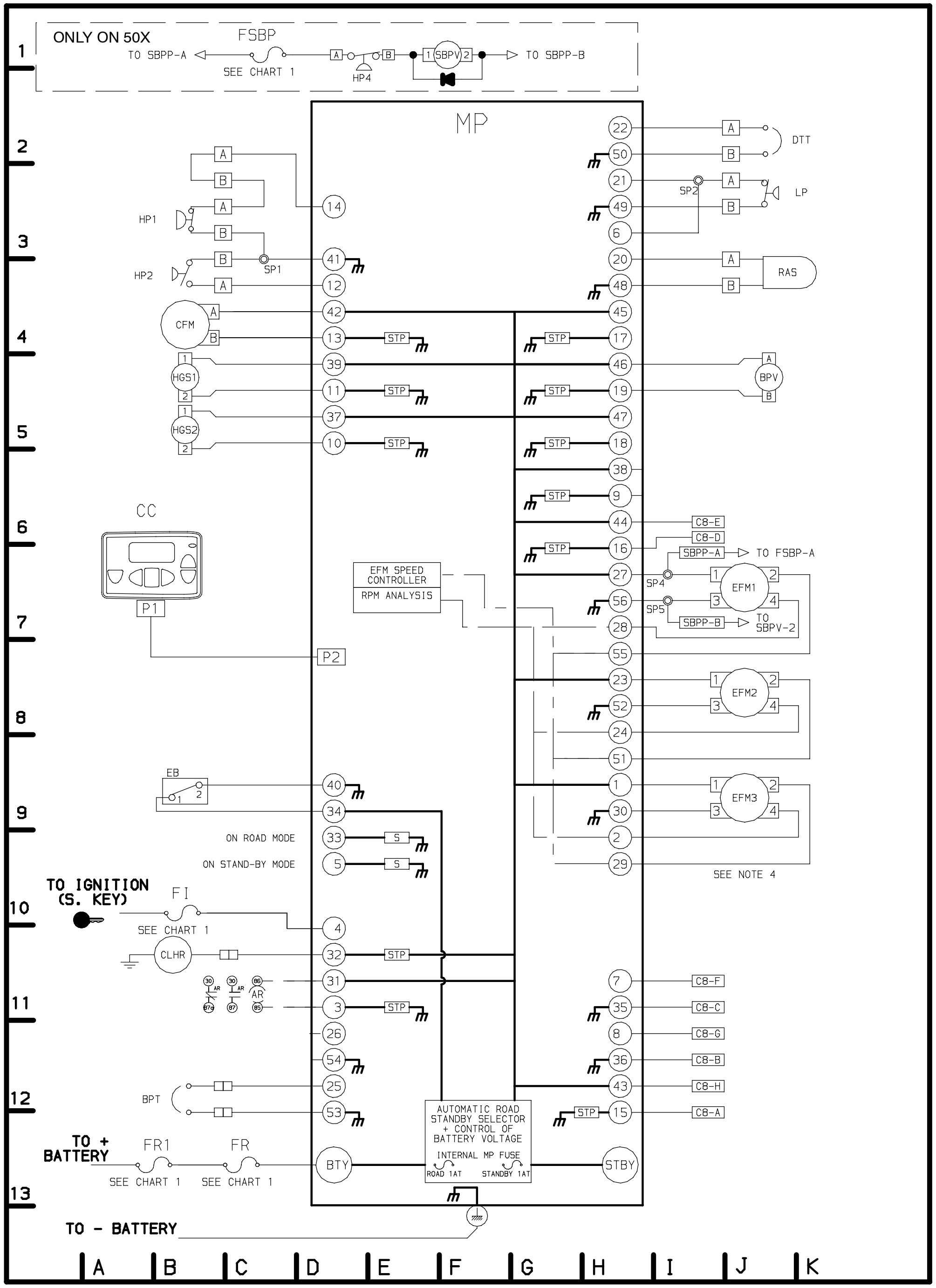
Under no circumstances should anyone attempt to service the microprocessor (see section 4.14). Should a problem develop with the microprocessor, contact your nearest Carrier Transicold dealer for replacement.

6.1 INTRODUCTION

Schematic diagrams for the unit models listed in Table 1-1 are provided herein.

LOCATION	SYMBOL	DESCRIPTION	LOCATION IN UNIT
C-11	AR	ALARM RELAY (OPTION)	EXTERNAL
B-12	BPT	QUENCH THERMOSTAT	ROAD COMPRESSOR
J-5	BPV	QUENCH VALVE	EVAPORATOR
B-6	CC	CAB COMMAND	CAB
B-4	CFM	CONDENSER FAN MOTOR	CONDENSER
B-11	CLHR	CLUTCH	ENGINE COMPARTMENT
J-2	DTT	DEFROST TERMINATION THERMOSTAT	EVAPORATOR
B-9	EB	EMERGENCY SWITCH	CONDENSER
J7,J8,J9	EFM 1, 2, 3	EVAPORATOR FAN MOTOR	EVAPORATOR
B-10	FI	IGNITION FUSE	ENGINE COMPARTMENT
A13, C13	FR, FR1	ROAD FUSE	CONDENSER/BATTERY
C-1	FSBP	SUCTION BYPASS FUSE	EVAPORATOR
B-3	HP1	HIGH PRESSURE SWITCH	CONDENSER
B-4	HP2	CONDENSER PRESSURE SWITCH	CONDENSER
D-1	HP4	HIGH AMBIENT PRESSURE SWITCH	EVAPORATOR
B-5	HGS1	HOT GAS SOLENOID VALVE	CONDENSER
B-5	HGS2	CONDENSER PRESSURE CONTROL VALVE	CONDENSER
J-2	LP	LOW PRESSURE SWITCH	EVAPORATOR
J-3	MP	MICROPROCESSOR BOARD	CONDENSER
F-13	MP FUSE	MICROPROCESSOR BOARD FUSE	CONDENSER
J-3	RAS	RETURN AIR SENSOR	EVAPORATOR
F-1	SBPV	SUCTION BYPASS VALVE	EVAPORATOR

Figure 6-1 Electrical Schematic Wiring Diagram - Based On Dwg. No. 62-61438 Rev C



NOTES:

1. UNIT SHOWN IN "OFF" POSITION.
2. WIRE IDENTIFICATION SYSTEM:
   COLOR: WHITE - DC CONTROL CIRCUITS
   GREEN - DC GROUND CIRCUITS
   RED - POSITIVE BATTERY CIRCUITS
   BLACK - NEGATIVE BATTERY CIRCUITS
3. ADDRESS SYSTEM: EXAMPLE: MP43/C8-A
   INDICATES A WIRE BETWEEN MICROPROCESSOR MP (PIN43) AND PLUG C8 (PINA).
4. ACCORDING TO EVAPORATOR CONFIGURATION.

- SP — INDICATES A SOLDERED SPLICE POINT
- T1 — PIN CONNECTION
- LIGHT LINES INDICATE WIRES IN THE SYSTEM
- NORMALLY CLOSED CONTACTS
- NORMALLY OPEN CONTACTS
- HC-F2 — MULTIPLE PLUG CONNECTION NUMBER
- B1 D — JUNCTION BLOCK CONNECTION
- SWITCH SYMBOL INDICATES MOMENTARY CONTACTS
- INDICATES A WIRE GROUND
- INDICATES A CHASSIS GROUND
- — - INDICATES OPTIONS
- INDICATES A CONNECTION, WIRE, LUG, ETC.
- INSULATING PLUG
- 1 — COMPONENT CONNECTION NUMBER OR LETTER
- STP — SWITCH THERMAL PROTECTOR

CHART 1	FI	FR	FR1	FSBP	MP FUSE
+BAT = 12V	1A	50A	60A	3A	1A

ROAD ONLY

Figure 6-2 Electrical Schematic Wiring Diagram - Based On Dwg. No. 62-61438 Rev C

NOTES:

1. UNIT SHOWN IN “OFF” POSITION.
2. WIRE IDENTIFICATION SYSTEM:
   COLOR: WHITE - DC CONTROL CIRCUITS
   GREEN - DC GROUND CIRCUITS
   RED - POSITIVE BATTERY CIRCUITS
   BLACK - NEGATIVE BATTERY CIRCUITS
3. ADDRESS SYSTEM: EXAMPLE: MP43/C8-A INDICATES A WIRE BETWEEN MICROPROCESSOR MP (PIN43) AND PLUG C8 (PINA).
4. ACCORDING TO EVAPORATOR CONFIGURATION.

- SP — INDICATES A SOLDERED SPLICE POINT
- T1 — PIN CONNECTION
- LIGHT LINES INDICATE WIRES IN THE SYSTEM
- NORMALLY CLOSED CONTACTS
- NORMALLY OPEN CONTACTS
- HC-F2 — MULTIPLE PLUG CONNECTION NUMBER
- B1 D — JUNCTION BLOCK CONNECTION
- SWITCH SYMBOL INDICATES MOMENTARY CONTACTS
- INDICATES A WIRE GROUND
- INDICATES A CHASSIS GROUND
- — - INDICATES OPTIONS
- ● INDICATES A CONNECTION, WIRE, LUG, ETC.
- INSULATING PLUG
- 1 — COMPONENT CONNECTION NUMBER OR LETTER
- STP — SWITCH THERMAL PROTECTOR

LOCATION	SYMBOL	DESCRIPTION	LOCATION IN UNIT	LOCATION	SYMBOL	DESCRIPTION	LOCATION IN UNIT
C-11	AR	ALARM RELAY (OPTION)	EXTERNAL	D-1	HP4	HIGH AMBIENT PRESSURE SWITCH	EVAPORATOR
B-12	BPT	QUENCH THERMOSTAT	ROAD COMPR.	B-5	HGS1	HOT GAS SOLENOID VALVE	CONDENSER
J-5	BPV	QUENCH VALVE	EVAPORATOR	B-5	HGS2	COND. PRESSURE CONTROL VALVE	CONDENSER
M-13	C1	FILTER CAPACITOR	CONDENSER	B-10	IGNITION	SWITCH KEY INFO (IGNITION)	ENGINE COMP.
O-3	CB	CIRCUIT BREAKER	STANDBY BOX	O-8	KR	KRIWAN RELAY MOTOR PROTECTION	STANDBY BOX
B-6	CC	CAB COMMAND	CAB	J-3	LP	LOW PRESSURE SWITCH	EVAPORATOR
B-4	CFM	CONDENSER FAN MOTOR	CONDENSER	J-12/N-7	MC	MOTOR CONTACTOR	STANDBY PANEL
B-11	CLHR	ROAD CLUTCH	ENGINE COMP.	F-2	MP	MICROPROCESSOR BOARD	CONDENSER
Q-6	CP	PERMANENT CAPACITOR	STANDBY PANEL	O-7	PTO	MOTOR INTERNAL THERMOSTAT	COMPRESSOR
R-6	CS1-2	START CAPACITOR	STANDBY PANEL	Q-4/Q-2	PSR	POWER SUPPLY RECEPTACLE	EXTERNAL
				L-13	R	DISCHARGE RESISTOR	CONDENSER
				J-4	RAS	RETURN AIR SENSOR	EVAPORATOR
J-2	DTT	DEFROST TERMINATION THERMOSTAT	EVAPORATOR	N-12	RB	RECTIFIER BRIDGE	CONDENSER
B-9	EB	EMERGENCY SWITCH	CONDENSER	P-12	RBT	RECTIFIER BRIDGE THERMISTOR	CONDENSER
J7,J8,J9	EFM1,2,3	EVAPORATOR FAN MOTOR	EVAPORATOR	R-6	RDCS	DISCHARGE RESISTOR ON START CAP.	START BOX
M-9	F1	PRIMARY TRANSFORMER FUSE	STANDBY PANEL	O-6	SBM	STANDBY MOTOR	CONDENSER
B-10	FI	IGNITION FUSE	ENGINE COMP.	F-1	SBPV	SUCTION BYPASS VALVE	EVAPORATOR
A13,C-13	FR, FR1	ROAD FUSE	CONDENSER/BATT.	Q-7	STR	START RELAY	STANDBY PANEL
I-13	FS	STANDBY FUSE	CONDENSER	P-11	TR	TRANSFORMER	CONDENSER
C-1	FSBP	SUCTION BYPASS FUSE	EVAPORATOR	P-12	TRT	TRANSFORMER THERMISTOR	CONDENSER
B-3	HP1	HIGH PRESSURE SWITCH	CONDENSER				
B-4	HP2	COND. PRESSURE CONTROL SWITCH	CONDENSER				
B-3	HP3	STANDBY HIGH PRESSURE SWITCH	CONDENSER				

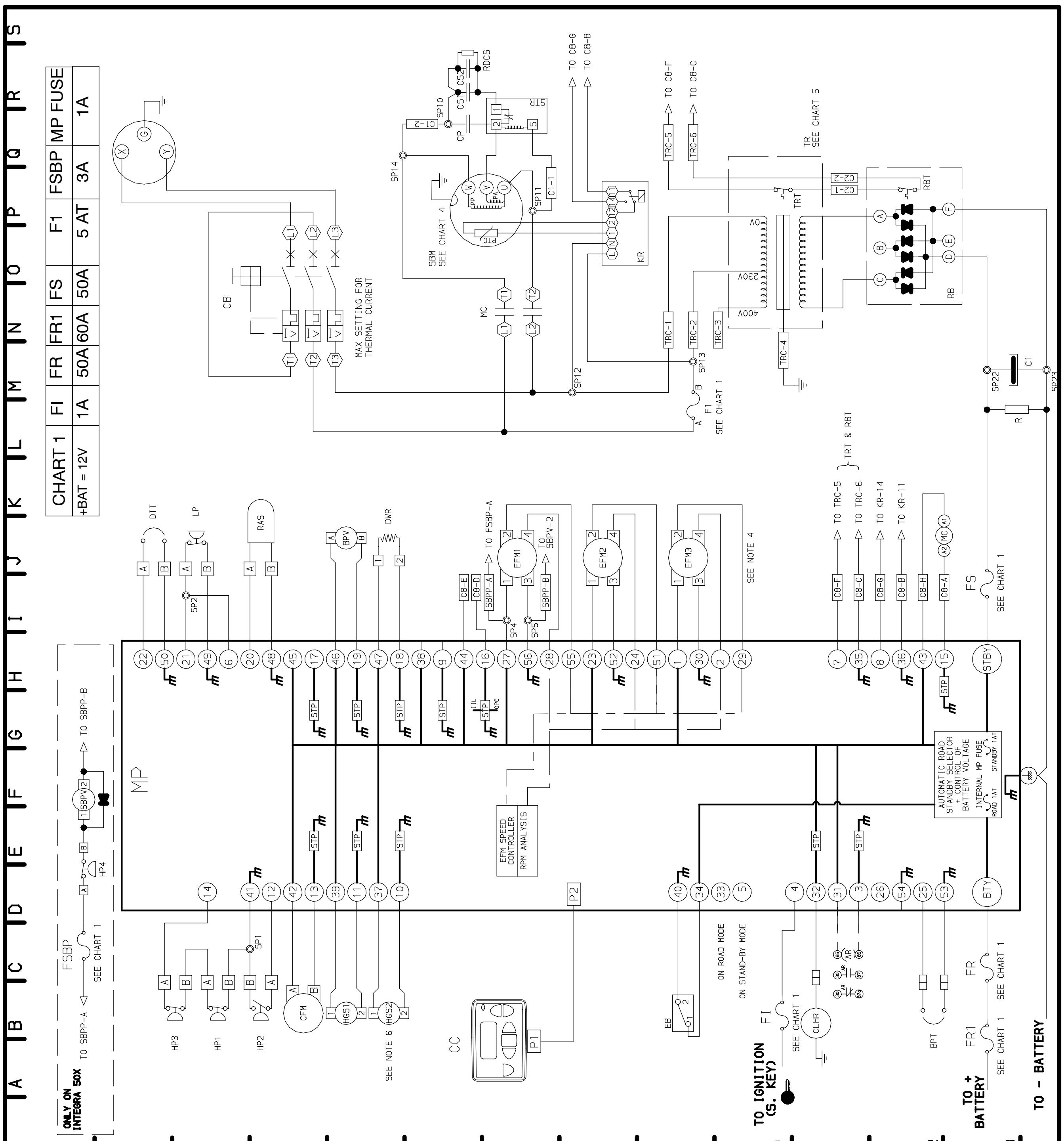


Figure 6-3 Electrical Schematic Wiring Diagram - Based On Dwg. No. 62-61456 Rev -

230V/1/60Hz

NOTES:

1. UNIT SHOWN IN "OFF" POSITION.

2. WIRE IDENTIFICATION SYSTEM:

COLOR: WHITE - DC CONTROL CIRCUITS
GREEN - DC GROUND CIRCUITS
RED - POSITIVE BATTERY CIRCUITS
BLACK - NEGATIVE BATTERY CIRCUITS

3. ADDRESS SYSTEM: EXAMPLE: MP43/C8-A
INDICATES A WIRE BETWEEN MICROPROCESSOR MP (PIN43) AND PLUG C8 (PINA).

4. ACCORDING TO EVAPORATOR CONFIGURATION.

5. MARKING FOR THE WIRES ARE: C12-9/1∅, C12-7/3∅

INDICATES A SOLDERED SPLICE POINT
PIN CONNECTION
LIGHT LINES INDICATE WIRES IN THE SYSTEM
NORMALLY CLOSED CONTACTS
NORMALLY OPEN CONTACTS
HC-F2 MULTIPLE PLUG CONNECTION NUMBER
B1 JUNCTION BLOCK CONNECTION
SWITCH SYMBOL INDICATES MOMENTARY CONTACTS
INDICATES A WIRE GROUND
INDICATES A CHASSIS GROUND
INDICATES OPTIONS
INDICATES A CONNECTION, WIRE, LUG, ETC.
INSULATING PLUG
1 COMPONENT CONNECTION NUMBER OR LETTER
STP SWITCH THERMAL PROTECTOR

LOCATION	SYMBOL	DESCRIPTION	LOCATION IN UNIT	LOCATION	SYMBOL	DESCRIPTION	LOCATION IN UNIT
C-11	AR	ALARM RELAY (OPTION)	EXTERNAL	F-2	MP	MICROPROCESSOR BOARD	CONDENSER
B-12	BPT	QUENCH THERMOSTAT	ROAD COMPR.	P-4/P-3	PSR	POWER SUPPLY RECEPTACLE	EXTERNAL
J-5	BPV	QUENCH VALVE	EVAPORATOR	N-7	PTO	MOTOR INTERNAL THERMOSTAT	COMPRESSOR
B-6	CC	CAB COMMAND	CAB	J-3	RAS	RETURN AIR SENSOR	EVAPORATOR
B-4	CFM	CONDENSER FAN MOTOR	CONDENSER	O-12	RB	RECTIFIER BRIDGE	CONDENSER
B-11	CLHR	ROAD CLUTCH	ENGINE COMP.	Q-12	RBT	RECTIFIER BRIDGE THERMISTOR	RECTIFIER BRIDGE
				R-6	SBM	STANDBY COMPRESSOR MOTOR	CONDENSER
J-2	DTT	DEFROST TERMINATION THERMOSTAT	EVAPORATOR	F-1	SBPV	SUCTION BYPASS VALVE	EVAPORATOR
				Q-9	TR	TRANSFORMER	CONDENSER
B-9	EB	EMERGENCY SWITCH	CONDENSER	R-11	TRT	TRANSFORMER THERMISTOR	TRANSFORMER
J7,J8,J9	EFM1,2,3	EVAPORATOR FAN MOTOR	EVAPORATOR	F-13	MP FUSE	MICROPROCESSOR BOARD FUSE	CONDENSER
M-9	F1, 2, 3	PRIMARY TRANSFORMER FUSE	STANDBY BOX				
N-4	FB	FUSE BLOCK	STANDBY BOX				
B-10	FI	IGNITION FUSE	ENGINE COMP.				
A-13/C-13	FR, FR1	ROAD FUSE	CONDENSER/BATT.				
I-13	FS	STANDBY FUSE	CONDENSER				
C-1	FSBP	SUCTION BYPASS FUSE	EVAPORATOR				
B-3	HP1	HIGH PRESSURE SWITCH	CONDENSER				
B-4	HP2	COND. PRESSURE CONTROL SWITCH	CONDENSER				
B-3	HP3	STANDBY HIGH PRESSURE SWITCH	CONDENSER				
D-1	HP4	HIGH AMBIENT PRESSURE SWITCH	EVAPORATOR				
B-5	HGS1	HOT GAS SOLENOID VALVE	CONDENSER				
B-5	HGS2	CONDENSER PRESSURE CONTROL VALVE	CONDENSER				
O-8	KR	KRIWAN RELAY MOTOR PROTECTION	STANDBY BOX				
J-2	LP	LOW PRESSURE SWITCH	CONDENSER				
J-12/N-6	MC	MOTOR CONTACTOR	STANDBY BOX				

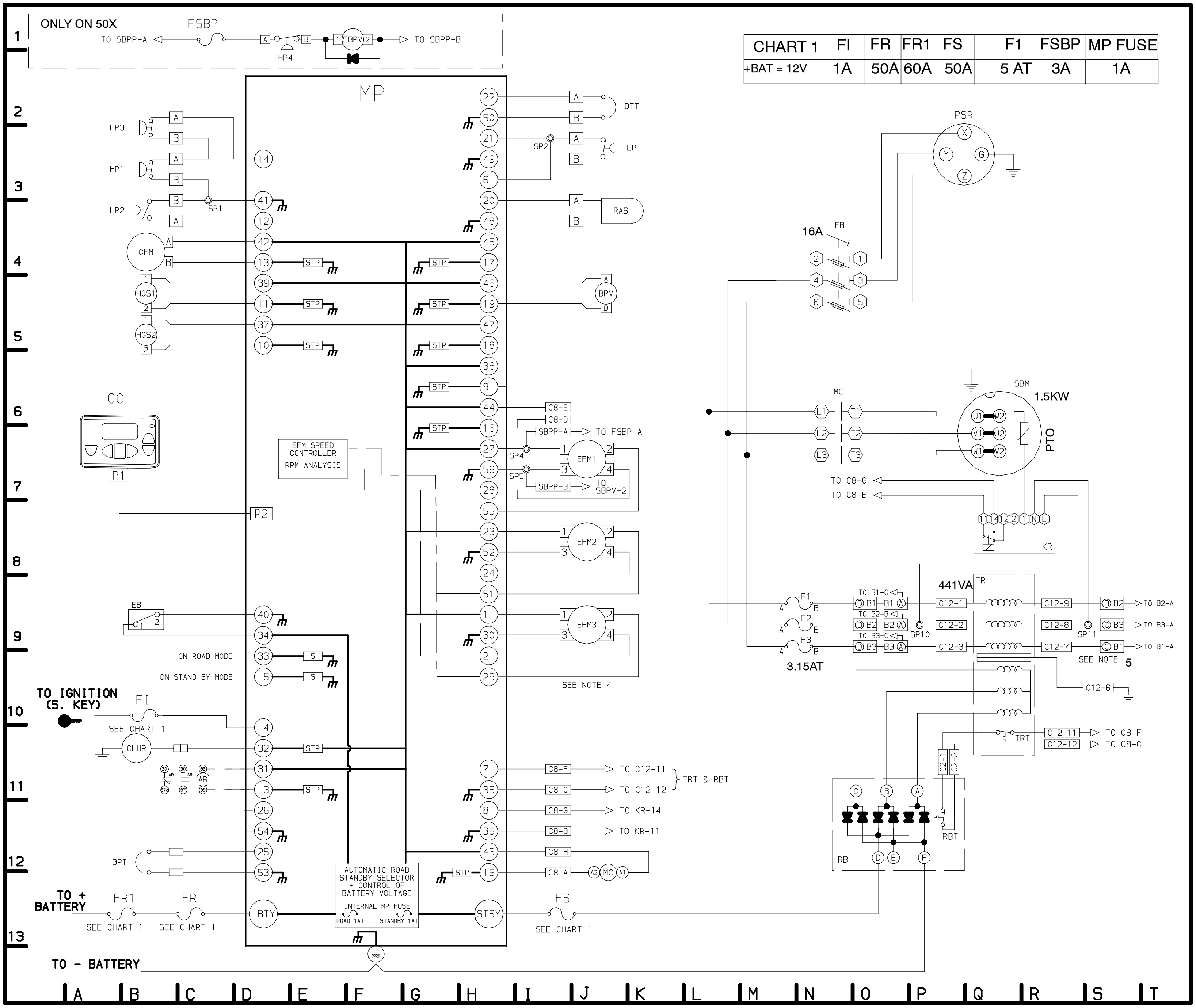


CHART 1	FI	FR	FR1	FS	F1	FSBP	MP FUSE
+BAT = 12V	1A	50A	60A	50A	5 AT	3A	1A

230V/3/60Hz

Figure 6-4 Electrical Schematic Wiring Diagram - Based On Dwg. No. 62-61440 Rev D

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